In [1]:

```
import pandas as pd
import numpy as np
```

In [6]:

```
import matplotlib.pyplot as plt
```

In [10]:

```
df = pd.read_csv("/home/rmdstic/Documents/TEA-14/HousingData.csv")
```

```
In [11]: df
```

Out[11]:

	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	296	15.3	396.90
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90
5	0.02985	0.0	2.18	0.0	0.458	6.430	58.7	6.0622	3	222	18.7	394.12
6	0.08829	12.5	7.87	NaN	0.524	6.012	66.6	5.5605	5	311	15.2	395.60
7	0.14455	12.5	7.87	0.0	0.524	6.172	96.1	5.9505	5	311	15.2	396.90
8	0.21124	12.5	7.87	0.0	0.524	5.631	100.0	6.0821	5	311	15.2	386.63
9	0.17004	12.5	7.87	NaN	0.524	6.004	85.9	6.5921	5	311	15.2	386.71
10	0.22489	12.5	7.87	0.0	0.524	6.377	94.3	6.3467	5	311	15.2	392.52
11	0.11747	12.5	7.87	0.0	0.524	6.009	82.9	6.2267	5	311	15.2	396.90
12	0.09378	12.5	7.87	0.0	0.524	5.889	39.0	5.4509	5	311	15.2	390.50
13	0.62976	0.0	8.14	0.0	0.538	5.949	61.8	4.7075	4	307	21.0	396.90
14	0.63796	0.0	8.14	NaN	0.538	6.096	84.5	4.4619	4	307	21.0	380.02
15	0.62739	0.0	8.14	0.0	0.538	5.834	56.5	4.4986	4	307	21.0	395.62
16	1.05393	0.0	8.14	0.0	0.538	5.935	29.3	4.4986	4	307	21.0	386.85
17	0.78420	0.0	8.14	0.0	0.538	5.990	81.7	4.2579	4	307	21.0	386.75
18	0.80271	0.0	8.14	0.0	0.538	5.456	36.6	3.7965	4	307	21.0	288.99
19	0.72580	0.0	8.14	0.0	0.538	5.727	69.5	3.7965	4	307	21.0	390.95
20	1.25179	0.0	8.14	0.0	0.538	5.570	98.1	3.7979	4	307	21.0	376.57
21	0.85204	0.0	8.14	0.0	0.538	5.965	89.2	4.0123	4	307	21.0	392.53
22	1.23247	0.0	8.14	0.0	0.538	6.142	91.7	3.9769	4	307	21.0	396.90
23	0.98843	0.0	8.14	0.0	0.538	5.813	100.0	4.0952	4	307	21.0	394.54
24	0.75026	0.0	8.14	0.0	0.538	5.924	94.1	4.3996	4	307	21.0	394.33
25	0.84054	0.0	8.14	0.0	0.538	5.599	85.7	4.4546	4	307	21.0	303.42
26	0.67191	0.0	8.14	0.0	0.538	5.813	90.3	4.6820	4	307	21.0	376.88
27	0.95577	0.0	8.14	0.0	0.538	6.047	88.8	4.4534	4	307	21.0	306.38
28	0.77299	0.0	8.14	0.0	0.538	6.495	94.4	4.4547	4	307	21.0	387.94
29	1.00245	0.0	8.14	0.0	0.538	6.674	87.3	4.2390	4	307	21.0	380.23
...	...	...	...	...	...	...	...	...	...	...	...	...
476	4.87141	0.0	18.10	0.0	0.614	6.484	93.6	2.3053	24	666	20.2	396.21
477	15.02340	0.0	18.10	0.0	0.614	5.304	97.3	2.1007	24	666	20.2	349.48
478	10.23300	0.0	18.10	0.0	0.614	6.185	96.7	2.1705	24	666	20.2	379.70
479	14.33370	0.0	18.10	NaN	0.614	6.229	88.0	1.9512	24	666	20.2	383.32

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B
480	5.82401	0.0	18.10	0.0	0.532	6.242	64.7	3.4242	24	666	20.2	396.90
481	5.70818	0.0	18.10	0.0	0.532	6.750	74.9	3.3317	24	666	20.2	393.07
482	5.73116	0.0	18.10	NaN	0.532	7.061	77.0	3.4106	24	666	20.2	395.28
483	2.81838	0.0	18.10	0.0	0.532	5.762	40.3	4.0983	24	666	20.2	392.92
484	2.37857	0.0	18.10	0.0	0.583	5.871	41.9	3.7240	24	666	20.2	370.73
485	3.67367	0.0	18.10	0.0	0.583	6.312	51.9	3.9917	24	666	20.2	388.62
486	5.69175	0.0	18.10	0.0	0.583	6.114	79.8	3.5459	24	666	20.2	392.68
487	4.83567	0.0	18.10	0.0	0.583	5.905	53.2	3.1523	24	666	20.2	388.22
488	0.15086	0.0	27.74	0.0	0.609	5.454	92.7	1.8209	4	711	20.1	395.09
489	0.18337	0.0	27.74	0.0	0.609	5.414	98.3	1.7554	4	711	20.1	344.05
490	0.20746	0.0	27.74	0.0	0.609	5.093	98.0	1.8226	4	711	20.1	318.43
491	0.10574	0.0	27.74	0.0	0.609	5.983	98.8	1.8681	4	711	20.1	390.11
492	0.11132	0.0	27.74	0.0	0.609	5.983	83.5	2.1099	4	711	20.1	396.90
493	0.17331	0.0	9.69	0.0	0.585	5.707	54.0	2.3817	6	391	19.2	396.90
494	0.27957	0.0	9.69	0.0	0.585	5.926	42.6	2.3817	6	391	19.2	396.90
495	0.17899	0.0	9.69	0.0	0.585	5.670	28.8	2.7986	6	391	19.2	393.29
496	0.28960	0.0	9.69	0.0	0.585	5.390	72.9	2.7986	6	391	19.2	396.90
497	0.26838	0.0	9.69	0.0	0.585	5.794	70.6	2.8927	6	391	19.2	396.90
498	0.23912	0.0	9.69	0.0	0.585	6.019	65.3	2.4091	6	391	19.2	396.90
499	0.17783	0.0	9.69	0.0	0.585	5.569	73.5	2.3999	6	391	19.2	395.77
500	0.22438	0.0	9.69	0.0	0.585	6.027	79.7	2.4982	6	391	19.2	396.90
501	0.06263	0.0	11.93	0.0	0.573	6.593	69.1	2.4786	1	273	21.0	391.99
502	0.04527	0.0	11.93	0.0	0.573	6.120	76.7	2.2875	1	273	21.0	396.90
503	0.06076	0.0	11.93	0.0	0.573	6.976	91.0	2.1675	1	273	21.0	396.90
504	0.10959	0.0	11.93	0.0	0.573	6.794	89.3	2.3889	1	273	21.0	393.45
505	0.04741	0.0	11.93	0.0	0.573	6.030	NaN	2.5050	1	273	21.0	396.90

506 rows × 14 columns

In [12]:

```
df.isnull().sum()
```

Out[12]:

```
CRIM       20
ZN         20
INDUS      20
CHAS       20
NOX         0
RM          0
AGE        20
DIS         0
RAD         0
TAX         0
PTRATIO     0
B           0
LSTAT      20
MEDV        0
dtype: int64
```

In [14]:
```
df["CRIM"].fillna(df["CRIM"].mean(),inplace=True)
df["ZN"].fillna(df["ZN"].mean(),inplace=True)
df["INDUS"].fillna(df["INDUS"].mean(),inplace=True)
df["CHAS"].fillna(df["CHAS"].mean(),inplace=True)
df["AGE"].fillna(df["AGE"].mean(),inplace=True)
df["LSTAT"].fillna(df["LSTAT"].mean(),inplace=True)
df
```

Out[14]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIC
0	0.00632	18.0	2.31	0.000000	0.538	6.575	65.200000	4.0900	1	296	15.3
1	0.02731	0.0	7.07	0.000000	0.469	6.421	78.900000	4.9671	2	242	17.8
2	0.02729	0.0	7.07	0.000000	0.469	7.185	61.100000	4.9671	2	242	17.8
3	0.03237	0.0	2.18	0.000000	0.458	6.998	45.800000	6.0622	3	222	18.7
4	0.06905	0.0	2.18	0.000000	0.458	7.147	54.200000	6.0622	3	222	18.7
5	0.02985	0.0	2.18	0.000000	0.458	6.430	58.700000	6.0622	3	222	18.7
6	0.08829	12.5	7.87	0.069959	0.524	6.012	66.600000	5.5605	5	311	15.2
7	0.14455	12.5	7.87	0.000000	0.524	6.172	96.100000	5.9505	5	311	15.2
8	0.21124	12.5	7.87	0.000000	0.524	5.631	100.000000	6.0821	5	311	15.2
9	0.17004	12.5	7.87	0.069959	0.524	6.004	85.900000	6.5921	5	311	15.2
10	0.22489	12.5	7.87	0.000000	0.524	6.377	94.300000	6.3467	5	311	15.2
11	0.11747	12.5	7.87	0.000000	0.524	6.009	82.900000	6.2267	5	311	15.2
12	0.09378	12.5	7.87	0.000000	0.524	5.889	39.000000	5.4509	5	311	15.2
13	0.62976	0.0	8.14	0.000000	0.538	5.949	61.800000	4.7075	4	307	21.0
14	0.63796	0.0	8.14	0.069959	0.538	6.096	84.500000	4.4619	4	307	21.0
15	0.62739	0.0	8.14	0.000000	0.538	5.834	56.500000	4.4986	4	307	21.0
16	1.05393	0.0	8.14	0.000000	0.538	5.935	29.300000	4.4986	4	307	21.0
17	0.78420	0.0	8.14	0.000000	0.538	5.990	81.700000	4.2579	4	307	21.0
18	0.80271	0.0	8.14	0.000000	0.538	5.456	36.600000	3.7965	4	307	21.0
19	0.72580	0.0	8.14	0.000000	0.538	5.727	69.500000	3.7965	4	307	21.0
20	1.25179	0.0	8.14	0.000000	0.538	5.570	98.100000	3.7979	4	307	21.0
21	0.85204	0.0	8.14	0.000000	0.538	5.965	89.200000	4.0123	4	307	21.0
22	1.23247	0.0	8.14	0.000000	0.538	6.142	91.700000	3.9769	4	307	21.0
23	0.98843	0.0	8.14	0.000000	0.538	5.813	100.000000	4.0952	4	307	21.0
24	0.75026	0.0	8.14	0.000000	0.538	5.924	94.100000	4.3996	4	307	21.0
25	0.84054	0.0	8.14	0.000000	0.538	5.599	85.700000	4.4546	4	307	21.0
26	0.67191	0.0	8.14	0.000000	0.538	5.813	90.300000	4.6820	4	307	21.0
27	0.95577	0.0	8.14	0.000000	0.538	6.047	88.800000	4.4534	4	307	21.0
28	0.77299	0.0	8.14	0.000000	0.538	6.495	94.400000	4.4547	4	307	21.0
29	1.00245	0.0	8.14	0.000000	0.538	6.674	87.300000	4.2390	4	307	21.0
...	...	...	...	...	...	...	...	...	...	...	..

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO
476	4.87141	0.0	18.10	0.000000	0.614	6.484	93.600000	2.3053	24	666	20.2
477	15.02340	0.0	18.10	0.000000	0.614	5.304	97.300000	2.1007	24	666	20.2
478	10.23300	0.0	18.10	0.000000	0.614	6.185	96.700000	2.1705	24	666	20.2
479	14.33370	0.0	18.10	0.069959	0.614	6.229	88.000000	1.9512	24	666	20.2
480	5.82401	0.0	18.10	0.000000	0.532	6.242	64.700000	3.4242	24	666	20.2
481	5.70818	0.0	18.10	0.000000	0.532	6.750	74.900000	3.3317	24	666	20.2
482	5.73116	0.0	18.10	0.069959	0.532	7.061	77.000000	3.4106	24	666	20.2
483	2.81838	0.0	18.10	0.000000	0.532	5.762	40.300000	4.0983	24	666	20.2
484	2.37857	0.0	18.10	0.000000	0.583	5.871	41.900000	3.7240	24	666	20.2
485	3.67367	0.0	18.10	0.000000	0.583	6.312	51.900000	3.9917	24	666	20.2
486	5.69175	0.0	18.10	0.000000	0.583	6.114	79.800000	3.5459	24	666	20.2
487	4.83567	0.0	18.10	0.000000	0.583	5.905	53.200000	3.1523	24	666	20.2
488	0.15086	0.0	27.74	0.000000	0.609	5.454	92.700000	1.8209	4	711	20.1
489	0.18337	0.0	27.74	0.000000	0.609	5.414	98.300000	1.7554	4	711	20.1
490	0.20746	0.0	27.74	0.000000	0.609	5.093	98.000000	1.8226	4	711	20.1
491	0.10574	0.0	27.74	0.000000	0.609	5.983	98.800000	1.8681	4	711	20.1
492	0.11132	0.0	27.74	0.000000	0.609	5.983	83.500000	2.1099	4	711	20.1
493	0.17331	0.0	9.69	0.000000	0.585	5.707	54.000000	2.3817	6	391	19.2
494	0.27957	0.0	9.69	0.000000	0.585	5.926	42.600000	2.3817	6	391	19.2
495	0.17899	0.0	9.69	0.000000	0.585	5.670	28.800000	2.7986	6	391	19.2
496	0.28960	0.0	9.69	0.000000	0.585	5.390	72.900000	2.7986	6	391	19.2
497	0.26838	0.0	9.69	0.000000	0.585	5.794	70.600000	2.8927	6	391	19.2
498	0.23912	0.0	9.69	0.000000	0.585	6.019	65.300000	2.4091	6	391	19.2
499	0.17783	0.0	9.69	0.000000	0.585	5.569	73.500000	2.3999	6	391	19.2
500	0.22438	0.0	9.69	0.000000	0.585	6.027	79.700000	2.4982	6	391	19.2
501	0.06263	0.0	11.93	0.000000	0.573	6.593	69.100000	2.4786	1	273	21.0
502	0.04527	0.0	11.93	0.000000	0.573	6.120	76.700000	2.2875	1	273	21.0
503	0.06076	0.0	11.93	0.000000	0.573	6.976	91.000000	2.1675	1	273	21.0
504	0.10959	0.0	11.93	0.000000	0.573	6.794	89.300000	2.3889	1	273	21.0
505	0.04741	0.0	11.93	0.000000	0.573	6.030	68.518519	2.5050	1	273	21.0

506 rows × 14 columns

In [15]:
```
df.isnull().sum()
```

Out[15]:
```
CRIM       0
ZN         0
INDUS      0
CHAS       0
NOX        0
RM         0
AGE        0
DIS        0
RAD        0
TAX        0
PTRATIO    0
B          0
LSTAT      0
MEDV       0
dtype: int64
```

```
In [16]: x = df.drop(['MEDV'], axis = 1)
         x
```

Out[16]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO
0	0.00632	18.0	2.31	0.000000	0.538	6.575	65.200000	4.0900	1	296	15.3
1	0.02731	0.0	7.07	0.000000	0.469	6.421	78.900000	4.9671	2	242	17.8
2	0.02729	0.0	7.07	0.000000	0.469	7.185	61.100000	4.9671	2	242	17.8
3	0.03237	0.0	2.18	0.000000	0.458	6.998	45.800000	6.0622	3	222	18.7
4	0.06905	0.0	2.18	0.000000	0.458	7.147	54.200000	6.0622	3	222	18.7
5	0.02985	0.0	2.18	0.000000	0.458	6.430	58.700000	6.0622	3	222	18.7
6	0.08829	12.5	7.87	0.069959	0.524	6.012	66.600000	5.5605	5	311	15.2
7	0.14455	12.5	7.87	0.000000	0.524	6.172	96.100000	5.9505	5	311	15.2
8	0.21124	12.5	7.87	0.000000	0.524	5.631	100.000000	6.0821	5	311	15.2
9	0.17004	12.5	7.87	0.069959	0.524	6.004	85.900000	6.5921	5	311	15.2
10	0.22489	12.5	7.87	0.000000	0.524	6.377	94.300000	6.3467	5	311	15.2
11	0.11747	12.5	7.87	0.000000	0.524	6.009	82.900000	6.2267	5	311	15.2
12	0.09378	12.5	7.87	0.000000	0.524	5.889	39.000000	5.4509	5	311	15.2
13	0.62976	0.0	8.14	0.000000	0.538	5.949	61.800000	4.7075	4	307	21.0
14	0.63796	0.0	8.14	0.069959	0.538	6.096	84.500000	4.4619	4	307	21.0
15	0.62739	0.0	8.14	0.000000	0.538	5.834	56.500000	4.4986	4	307	21.0
16	1.05393	0.0	8.14	0.000000	0.538	5.935	29.300000	4.4986	4	307	21.0
17	0.78420	0.0	8.14	0.000000	0.538	5.990	81.700000	4.2579	4	307	21.0
18	0.80271	0.0	8.14	0.000000	0.538	5.456	36.600000	3.7965	4	307	21.0
19	0.72580	0.0	8.14	0.000000	0.538	5.727	69.500000	3.7965	4	307	21.0
20	1.25179	0.0	8.14	0.000000	0.538	5.570	98.100000	3.7979	4	307	21.0
21	0.85204	0.0	8.14	0.000000	0.538	5.965	89.200000	4.0123	4	307	21.0
22	1.23247	0.0	8.14	0.000000	0.538	6.142	91.700000	3.9769	4	307	21.0
23	0.98843	0.0	8.14	0.000000	0.538	5.813	100.000000	4.0952	4	307	21.0
24	0.75026	0.0	8.14	0.000000	0.538	5.924	94.100000	4.3996	4	307	21.0
25	0.84054	0.0	8.14	0.000000	0.538	5.599	85.700000	4.4546	4	307	21.0
26	0.67191	0.0	8.14	0.000000	0.538	5.813	90.300000	4.6820	4	307	21.0
27	0.95577	0.0	8.14	0.000000	0.538	6.047	88.800000	4.4534	4	307	21.0
28	0.77299	0.0	8.14	0.000000	0.538	6.495	94.400000	4.4547	4	307	21.0
29	1.00245	0.0	8.14	0.000000	0.538	6.674	87.300000	4.2390	4	307	21.0
...	...	...	...	...	...	...	...	...	...	...	...
476	4.87141	0.0	18.10	0.000000	0.614	6.484	93.600000	2.3053	24	666	20.2
477	15.02340	0.0	18.10	0.000000	0.614	5.304	97.300000	2.1007	24	666	20.2
478	10.23300	0.0	18.10	0.000000	0.614	6.185	96.700000	2.1705	24	666	20.2

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO
479	14.33370	0.0	18.10	0.069959	0.614	6.229	88.000000	1.9512	24	666	20.2
480	5.82401	0.0	18.10	0.000000	0.532	6.242	64.700000	3.4242	24	666	20.2
481	5.70818	0.0	18.10	0.000000	0.532	6.750	74.900000	3.3317	24	666	20.2
482	5.73116	0.0	18.10	0.069959	0.532	7.061	77.000000	3.4106	24	666	20.2
483	2.81838	0.0	18.10	0.000000	0.532	5.762	40.300000	4.0983	24	666	20.2
484	2.37857	0.0	18.10	0.000000	0.583	5.871	41.900000	3.7240	24	666	20.2
485	3.67367	0.0	18.10	0.000000	0.583	6.312	51.900000	3.9917	24	666	20.2
486	5.69175	0.0	18.10	0.000000	0.583	6.114	79.800000	3.5459	24	666	20.2
487	4.83567	0.0	18.10	0.000000	0.583	5.905	53.200000	3.1523	24	666	20.2
488	0.15086	0.0	27.74	0.000000	0.609	5.454	92.700000	1.8209	4	711	20.1
489	0.18337	0.0	27.74	0.000000	0.609	5.414	98.300000	1.7554	4	711	20.1
490	0.20746	0.0	27.74	0.000000	0.609	5.093	98.000000	1.8226	4	711	20.1
491	0.10574	0.0	27.74	0.000000	0.609	5.983	98.800000	1.8681	4	711	20.1
492	0.11132	0.0	27.74	0.000000	0.609	5.983	83.500000	2.1099	4	711	20.1
493	0.17331	0.0	9.69	0.000000	0.585	5.707	54.000000	2.3817	6	391	19.2
494	0.27957	0.0	9.69	0.000000	0.585	5.926	42.600000	2.3817	6	391	19.2
495	0.17899	0.0	9.69	0.000000	0.585	5.670	28.800000	2.7986	6	391	19.2
496	0.28960	0.0	9.69	0.000000	0.585	5.390	72.900000	2.7986	6	391	19.2
497	0.26838	0.0	9.69	0.000000	0.585	5.794	70.600000	2.8927	6	391	19.2
498	0.23912	0.0	9.69	0.000000	0.585	6.019	65.300000	2.4091	6	391	19.2
499	0.17783	0.0	9.69	0.000000	0.585	5.569	73.500000	2.3999	6	391	19.2
500	0.22438	0.0	9.69	0.000000	0.585	6.027	79.700000	2.4982	6	391	19.2
501	0.06263	0.0	11.93	0.000000	0.573	6.593	69.100000	2.4786	1	273	21.0
502	0.04527	0.0	11.93	0.000000	0.573	6.120	76.700000	2.2875	1	273	21.0
503	0.06076	0.0	11.93	0.000000	0.573	6.976	91.000000	2.1675	1	273	21.0
504	0.10959	0.0	11.93	0.000000	0.573	6.794	89.300000	2.3889	1	273	21.0
505	0.04741	0.0	11.93	0.000000	0.573	6.030	68.518519	2.5050	1	273	21.0

506 rows × 13 columns

In [17]:
```
y=df['MEDV']
y
```

Out[17]:
```
0      24.0
1      21.6
2      34.7
3      33.4
4      36.2
5      28.7
6      22.9
7      27.1
8      16.5
9      18.9
10     15.0
11     18.9
12     21.7
13     20.4
14     18.2
15     19.9
16     23.1
17     17.5
18     20.2
19     18.2
20     13.6
21     19.6
22     15.2
23     14.5
24     15.6
25     13.9
26     16.6
27     14.8
28     18.4
29     21.0
       ...
476    16.7
477    12.0
478    14.6
479    21.4
480    23.0
481    23.7
482    25.0
483    21.8
484    20.6
485    21.2
486    19.1
487    20.6
488    15.2
489     7.0
490     8.1
491    13.6
492    20.1
493    21.8
494    24.5
495    23.1
496    19.7
497    18.3
498    21.2
499    17.5
500    16.8
```

```
501    22.4
502    20.6
503    23.9
504    22.0
505    11.9
Name: MEDV, Length: 506, dtype: float64
```

In [18]:
```
from sklearn.model_selection import train_test_split
xtrain, xtest, ytrain, ytest =train_test_split(x, y, test_size =0.2,
```

In [19]:
```
from sklearn.linear_model import LinearRegression
lm = LinearRegression()
lm.fit(xtrain, ytrain)
```

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

In [21]:
```
ytrain_pred = lm.predict(xtrain)
ytest_pred = lm.predict(xtest)
```

In [22]:
```
ytrain_pred
```

Out[22]:
```
array([32.81627321, 22.44810156, 28.03766232, 23.75733198,  6.50947
414,
       14.03444098, 22.08820099, 29.25415603, 32.5690748 , 13.05640
904,
       20.22623633, 21.50935141, 13.130115  , 23.97459357,  5.94369
526,
       19.18872715,  9.22208539, 45.332114  , 30.74904711, 17.36508
271,
       17.89690787, 21.8538289 , 23.41427455, 19.26643055, 35.01060
92 ,
       13.80465069, 20.97652211, 35.5947274 , 19.11750028, 13.64565
313,
       13.99390551, 22.3513967 , 14.97018808, 31.41563776, 25.42200
597,
       16.12261841, 24.8151741 ,  9.77305866, 14.99985459, 21.70695
03 ,
       33.07056401, 28.27079451, 24.99059687, 15.53957856, 31.81310
73 ,
       25.31962943, 14.20026892,  7.85538779, 27.95901931, 25.43216
539,
        5.06592749, 28.31123002, 16.96468964, 29.9148188 , 19.39108
637,
       16.30580326, 18.42774446, 12.95370034,  8.93495761, 19.25886
782,
       34.02016271, 32.86420157, 23.95497256, 20.14492197, 22.95083
775,
       26.67615398, 21.10735155, 17.74979344, 32.38278077, 10.58254
731,
       19.13318567, 31.64516362, 18.84520418, 15.78422296, 18.94046
927,
       15.11678414, 24.07458559, 23.66247081, 17.31713844, 13.21910
258,
       20.51857201, 24.22417338, 17.56807076, 25.39478716, 22.84498
687,
       28.06459103, 36.75378827, 16.43162613, 12.07850424, 35.04746
739,
       31.32063269, 20.48029146, 39.84323922, 28.61226369, 28.52233
259,
       17.5436698 , 26.81225348, 40.46530719, 27.56913544, 17.03883
567,
       37.52638916, 35.8229176 , 14.0961138 , 27.81731446, 21.94869
655,
       24.8818496 , 21.19719131, 23.45740081, 28.00487668, 29.57431
557,
       13.98506722, 26.16081663, 22.9901289 , 13.49729741, 14.06839
936,
       25.56540702, 19.52524407, 30.57606788, 10.04770818, 24.37160
039,
       17.17149942, 17.0112022 , 22.84937882, 21.67962795, 12.22063
591,
       25.20446182, 28.42197799, 20.75309338, 12.37886993, 25.11306
051,
       26.49461989, 25.70733316, 23.55013679, 25.89336895, 19.39553
691,
       20.85778701, 36.13738934, 21.1272548 , 36.28019204, 25.81708
451,
       20.90978431, 15.58319854, 31.98314685, 21.54080142, 28.05396
```

```
355,
       14.844027  , 32.73726538, 14.35524691,  1.67919971, 19.44711
142,
       13.87157102, 37.66832351, 16.30974204, 14.5549353 , 26.76951
017,
       23.52976973, 17.9629898 , 31.18728628, 25.18377746, 27.61576
19 ,
       24.80190806, 22.65264492, 22.46031495, 11.15172696, 20.91842
234,
       11.68647636, 17.73974341, 12.46032947, 27.77373401, 15.19251
431,
       15.99965125, 28.65756198, 14.46036826, 21.62746997, 12.64254
329,
       14.45555483, 23.36423324, 21.29797228, 14.93440596, 17.48649
966,
       13.45046456, 24.24295419, 12.50361345, 35.3211587 , 14.03760
167,
       43.21873439, 31.66742609, 34.8841818 , 22.01139076, 15.82180
035,
       26.85423351, 29.2313597 , 13.77457177, 26.727208  , 36.27945
842,
       16.83686285, 11.36251837, 34.42259379, 35.99230127, 17.96133
076,
       21.19847959, 18.52795439, 24.4993728 , 19.58258696, 27.19006
66 ,
       -4.30707212, 20.86540926, 32.56708668, 35.64347839, 25.17123
763,
       26.89080764, 20.27656175, 21.38857599, 15.98382948, 17.86132
517,
       21.07756281, 28.04291179, 19.96986817,  6.97597498, 16.23743
192,
       32.36451304, 35.49074744, 16.44786434, 18.93927412, 22.33854
817,
        6.31311559, 21.58666499, 23.55661668, 15.92257792, 18.47627
952,
       23.05203916, 27.21603015, 25.92177059, 32.83874569, 14.87693
591,
       28.97948914, 25.26104179, 21.07941467, 38.66910342, 20.48523
852,
       23.62439463, 22.76124186, 11.92347536, 19.99770627, 33.42769
853,
       24.80122075, 17.81400458, 33.31685947, 22.07230652, 28.71857
835,
       32.15452084, 36.60591303, 21.92092982, 24.10484055, 23.11676
177,
       32.01346165, 22.26638068, 18.36298427, 21.92771527, 29.11853
042,
       22.86612836, 22.06878986, 17.24027069, 17.3597754 , 16.97472
858,
       16.93337092, 16.77794732, 32.03226006, 23.32756224, 17.49983
857,
       19.30181049, 34.16756391, 14.14434098, 25.93018821, 17.01947
728,
       30.72513401, 30.03828448, 21.25506147, 20.3298965 , 36.06896
982,
       20.55702264, 33.38547011, 21.24908409, 31.57709481, 30.27897
298,
       37.42356288, 25.97972218, 21.09103073, 29.15810192, 15.96108
991,
       26.18276066, 21.50175208, 30.02080424, 10.53454993, 31.34892
```

```
003,
        6.17985967, 15.25781318, 20.54161826, 35.68172035, 31.93778
897,
       12.06580266, 13.62606496, 21.96053599, 34.80135807, 18.76201
757,
       18.62293267, 14.91881869, 25.48278612, 41.01931145, 25.34871
174,
       42.07887857, 25.45001621, 21.13187064, 12.07131249, 15.86997
446,
       14.20602197, 18.51957266,  3.01474407, 27.73065016, 26.41221
664,
       41.70198443, 21.64461258, 21.05335926, 34.0757984 , 32.95054
801,
        9.64398016, 24.85070793, 43.79024787, 21.78807344, 17.69205
74 ,
       26.16218871, 18.58628594,  6.34645098, 18.91507749, 35.66319
094,
       16.30328017, 23.75087974, 13.14594653, 24.39977842, 18.271
,
       17.18171595, 18.47353031, 33.00268863, 19.48068366, 29.83962
214,
       31.93425646, 41.60423999, 18.49648542, 16.12293921, 38.25510
656,
       17.76581487, 10.55196656, 14.7688579 , 25.35067163, 19.46964
974,
       16.46915179, 26.67604749, 13.37142686,  5.91891273, 18.71816
701,
       10.83757858, 28.50859921,  4.96207098, 28.66572375, 32.80875
045,
       22.61360755, 16.44226312, 17.93061892, 21.13503675, 34.02654
674,
       28.24386741, 19.33997782, 20.46592732,  6.76629059, 28.97480
848,
       25.03253899, 22.44360225, 13.7417905 , 24.80011236, 19.46303
725,
        8.97368226, 26.78806235, 16.0120091 , 31.5636985 , 31.99530
544,
       25.19164941, 18.43188624, 30.61644449, 21.28067267, 25.93113
95 ,
       24.31670018, 31.19585054, 24.60225016, 31.38261045, 17.64408
955,
       19.80887282, 18.65517922, 41.33253844, 25.56986444, 19.34047
326,
       33.40599414, 23.70130494, 18.3221544 , 23.25156216])
```

In [23]:

```
lm.predict([[0.00632,18.0,2.31,0.000000,0.538,6.575,65.200000,4.0900
```

Out[23]:

```
array([30.72513401])
```

In [24]:

```
ytest_pred
```

Out[24]:

```
array([26.175296  , 22.64747588, 29.1456294 , 11.52971235, 21.65312
134,
       19.42320699, 20.18413017, 21.46914355, 19.1985363 , 19.98228
162,
        4.32483046, 16.16891668, 16.87682404,  5.31232373, 39.36827
861,
       33.09358732, 21.9152876 , 36.61918436, 31.52676377, 23.52713
482,
       24.96022461, 23.69866912, 20.88033802, 30.55074901, 22.74081
741,
        8.66805959, 17.65119072, 17.93088633, 36.01223185, 21.16299
556,
       17.83464361, 17.43306603, 19.5240167 , 23.50605522, 28.97262
793,
       19.21808862, 11.23997435, 23.94256597, 17.86786717, 15.40849
806,
       26.3630836 , 21.5193299 , 23.78733694, 14.84041522, 23.94451
75 ,
       24.97067627, 20.11366175, 23.08636158, 10.42208266, 24.52832
122,
       21.60847326, 18.66228165, 24.53362832, 31.03502944, 12.97457
826,
       22.38536236, 21.34822822, 16.10928673, 12.37477824, 22.78596
712,
       18.28714824, 21.91802045, 32.49771603, 31.21256855, 17.47867
791,
       33.18861907, 19.17896285, 19.94662594, 20.17142015, 23.90228
857,
       22.81288844, 24.17911208, 30.83402844, 28.87481037, 25.14581
721,
        5.55072029, 37.0183454 , 24.15428003, 27.67587636, 19.63884
644,
       28.74874123, 18.83204358, 17.63305678, 37.97947167, 39.49507
972,
       24.17228966, 25.33605088, 16.75044819, 25.43224687, 16.65089
426,
       16.49186628, 13.37283452, 24.81689254, 31.21188699, 22.08919
19 ,
       20.49360168,  0.8229737 , 25.5004737 , 15.5481509 , 17.72901
193,
       25.77663998, 22.43131323])
```

```
In [25]: ytrain
```

```
Out[25]: 220    26.7
         71     21.7
         240    22.0
         6      22.9
         417    10.4
         366    21.9
         502    20.6
         302    26.4
         157    41.3
         408    17.2
         7      27.1
         118    20.4
         8      16.5
         208    24.4
         438     8.4
         132    23.0
         392     9.7
         283    50.0
         191    30.5
         383    12.3
         49     19.4
         498    21.2
         309    20.3
         124    18.8
         306    33.4
         245    18.5
         59     19.6
         276    33.2
         395    13.1
         416     7.5
                ...
         265    22.8
         72     22.8
         333    22.2
         25     13.9
         165    25.0
         337    18.5
         489     7.0
         174    22.6
         492    20.1
         39     30.8
         193    31.1
         314    23.8
         396    12.5
         88     23.6
         472    23.2
         70     24.2
         87     22.2
         292    27.9
         242    22.2
         277    33.1
         211    19.3
         9      18.9
         359    22.6
         195    50.0
         251    24.8
         323    18.5
```

```
192    36.4
117    19.2
47     16.6
172    23.1
Name: MEDV, Length: 404, dtype: float64
```

```
In [26]: ytest
```

```
Out[26]: 329    22.6
         371    50.0
         219    23.0
         403     8.3
         78     21.2
         15     19.9
         487    20.6
         340    18.7
         310    16.1
         102    18.6
         418     8.8
         411    17.2
         446    14.9
         386    10.5
         162    50.0
         299    29.0
         480    23.0
         196    33.3
         175    29.4
         37     21.0
         320    23.8
         171    19.1
         107    20.4
         278    29.1
         45     19.3
         367    23.1
         21     19.6
         153    19.4
         97     38.7
         113    18.7
                ...
         65     23.5
         344    31.2
         481    23.7
         387     7.4
         233    48.3
         206    24.4
         90     22.6
         497    18.3
         239    23.3
         137    17.1
         407    27.9
         224    44.8
         225    50.0
         326    23.0
         96     21.4
         426    10.2
         159    23.3
         391    23.2
         54     18.9
         435    13.4
         254    21.9
         300    24.8
         505    11.9
         246    24.3
         374    13.8
         56     24.7
```

```
455    14.1
60     18.7
213    28.1
108    19.8
Name: MEDV, Length: 102, dtype: float64
```

In [27]:

```
df1=pd.DataFrame(ytrain_pred,ytrain)
df2=pd.DataFrame(ytest_pred,ytest)
```

```
In [28]: df1
```

Out[28]:

	0
MEDV	
26.7	32.816273
21.7	22.448102
22.0	28.037662
22.9	23.757332
10.4	6.509474
21.9	14.034441
20.6	22.088201
26.4	29.254156
41.3	32.569075
17.2	13.056409
27.1	20.226236
20.4	21.509351
16.5	13.130115
24.4	23.974594
8.4	5.943695
23.0	19.188727
9.7	9.222085
50.0	45.332114
30.5	30.749047
12.3	17.365083
19.4	17.896908
21.2	21.853829
20.3	23.414275
18.8	19.266431
33.4	35.010609
18.5	13.804651
19.6	20.976522
33.2	35.594727
13.1	19.117500
7.5	13.645653
...	...
22.8	28.974808
22.8	25.032539
22.2	22.443602

	0
MEDV	
13.9	13.741790
25.0	24.800112
18.5	19.463037
7.0	8.973682
22.6	26.788062
20.1	16.012009
30.8	31.563698
31.1	31.995305
23.8	25.191649
12.5	18.431886
23.6	30.616444
23.2	21.280673
24.2	25.931140
22.2	24.316700
27.9	31.195851
22.2	24.602250
33.1	31.382610
19.3	17.644090
18.9	19.808873
22.6	18.655179
50.0	41.332538
24.8	25.569864
18.5	19.340473
36.4	33.405994
19.2	23.701305
16.6	18.322154
23.1	23.251562

404 rows × 1 columns

In [29]:
```
df2
```

Out[29]:

	0
MEDV	
22.6	26.175296
50.0	22.647476
23.0	29.145629
8.3	11.529712
21.2	21.653121
19.9	19.423207
20.6	20.184130
18.7	21.469144
16.1	19.198536
18.6	19.982282
8.8	4.324830
17.2	16.168917
14.9	16.876824
10.5	5.312324
50.0	39.368279
29.0	33.093587
23.0	21.915288
33.3	36.619184
29.4	31.526764
21.0	23.527135
23.8	24.960225
19.1	23.698669
20.4	20.880338
29.1	30.550749
19.3	22.740817
23.1	8.668060
19.6	17.651191
19.4	17.930886
38.7	36.012232
18.7	21.162996
...	...
23.5	30.834028
31.2	28.874810
23.7	25.145817

	0
MEDV	
7.4	5.550720
48.3	37.018345
24.4	24.154280
22.6	27.675876
18.3	19.638846
23.3	28.748741
17.1	18.832044
27.9	17.633057
44.8	37.979472
50.0	39.495080
23.0	24.172290
21.4	25.336051
10.2	16.750448
23.3	25.432247
23.2	16.650894
18.9	16.491866
13.4	13.372835
21.9	24.816893
24.8	31.211887
11.9	22.089192
24.3	20.493602
13.8	0.822974
24.7	25.500474
14.1	15.548151
18.7	17.729012
28.1	25.776640
19.8	22.431313

102 rows × 1 columns

```
In [30]: from sklearn.metrics import mean_squared_error, r2_score
         mse = mean_squared_error(ytest, ytest_pred)
         print(mse)
```

```
34.98738954423896
```

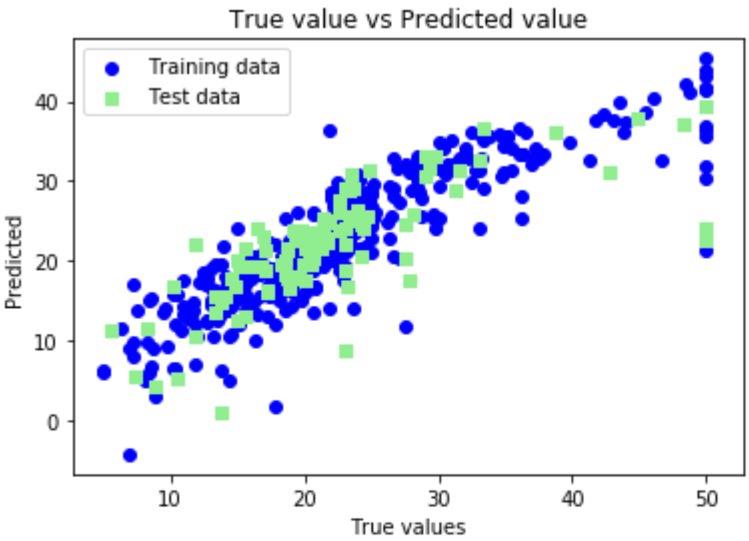
```
In [31]: mse = mean_squared_error(ytrain_pred,ytrain)
         print(mse)
```

```
20.019115913036593
```

In [33]:
```
r2=r2_score(ytest, ytest_pred)
r2
```

Out[33]:
```
0.5703296053895535
```

In [35]:
```
plt.scatter(ytrain ,ytrain_pred,c='blue',marker='o',label='Training
plt.scatter(ytest,ytest_pred ,c='lightgreen',marker='s',label='Test
plt.xlabel('True values')
plt.ylabel('Predicted')
plt.title("True value vs Predicted value")
plt.legend(loc= 'upper left')
#plt.hlines(y=0,xmin=0,xmax=50)
plt.plot()
plt.show()
```



In [ ]: