Importing Packages

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

Loading & Analysing Our Data

In [2]:
```
housing = pd.read_csv("HouseData.csv")
housing.head()
```

Out[2]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT	MEDV
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90	4.98	24.0
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90	9.14	21.6
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	392.83	4.03	34.7
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63	2.94	33.4
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90	5.33	36.2

In [3]:
```
housing.info()
```

```
<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    int64  
 4   NOX      506 non-null    float64
 5   RM       501 non-null    float64
 6   AGE      506 non-null    float64
 7   DIS      506 non-null    float64
 8   RAD      506 non-null    int64  
 9   TAX      506 non-null    int64  
 10  PTRATIO  506 non-null    float64
 11  B        506 non-null    float64
 12  LSTAT    506 non-null    float64
 13  MEDV     506 non-null    float64
dtypes: float64(11), int64(3)
memory usage: 55.5 KB
```

Splitting Our Training & Testing Data

In [4]:
```
from sklearn.model_selection import train_test_split
train_data,test_data = train_test_split(housing,test_size=0.2,random_state=42)
print(len(train_data),len(test_data))
```

```
404 102
```

In [5]:
```
housing["CHAS"].value_counts()
```

Out[5]:
```
0    471
1     35
Name: CHAS, dtype: int64
```

In our dataset 35 datapoints have 1 as the value for "CHAS" attribute and it might so happen that all these 35 data points goes into testing data and hence to resolve this issue we use Stratified Shuffle Split.

In [6]:
```
from sklearn.model_selection import StratifiedShuffleSplit
split = StratifiedShuffleSplit(n_splits=1,test_size=0.2,random_state=42)
for train_index,test_index in split.split(housing,housing['CHAS']):
    train_strat = housing.loc[train_index]
    test_strat = housing.loc[test_index]
```

In [7]:
```
train_strat["CHAS"].value_counts()
```

Out[7]:
```
0    376
1     28
Name: CHAS, dtype: int64
```

In [8]:
```
test_strat['CHAS'].value_counts()
```

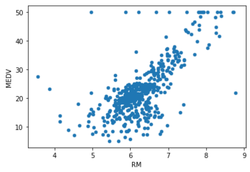
Out[8]:
```
0    95
1     7
Name: CHAS, dtype: int64
```

Finding & Understanding Correlations

In [9]:
```
corr_matrix = housing.corr()
corr_matrix["MEDV"].sort_values(ascending=False)
```

Out[9]:
```
MEDV       1.000000
RM         0.696169
ZN         0.360445
B          0.333461
DIS        0.249929
CHAS       0.175260
AGE       -0.376955
RAD       -0.381626
CRIM      -0.388305
NOX       -0.427321
TAX       -0.468536
INDUS     -0.483725
PTRATIO   -0.507787
LSTAT     -0.737663
Name: MEDV, dtype: float64
```

In [10]:
```
housing.plot(kind="scatter",x="RM",y="MEDV")
plt.show()
```



In [11]:
```
training_data = train_strat.drop("MEDV",axis=1)
training_labels = train_strat["MEDV"].copy()
```

Use of Imputer For Handling Missing Values

In [12]:
```
from sklearn.impute import SimpleImputer
imputer = SimpleImputer(strategy='median')
imputer.fit(training_data)
```

Out[12]:
```
SimpleImputer(strategy='median')
```

In [13]:
```
imputed_data = imputer.transform(training_data)
training_data_new = pd.DataFrame(imputed_data,columns=training_data.columns)
```

In [14]:
```
training_data_new.describe()
```

Out[14]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT
count	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000	404.000000
mean	3.602814	10.836634	11.344950	0.069307	0.558064	6.278609	69.039851	3.746210	9.735149	412.341584	18.473267	353.392822	12.791609
std	8.099383	22.150636	6.877817	0.254290	0.116875	0.712366	28.258248	2.099057	8.731259	168.672623	2.129243	96.069235	7.235740
min	0.006320	0.000000	0.740000	0.000000	0.389000	3.561000	2.900000	1.129600	1.000000	187.000000	13.000000	0.320000	1.730000
25%	0.086963	0.000000	5.190000	0.000000	0.453000	5.878750	44.850000	2.035975	4.000000	284.000000	17.400000	374.617500	6.847500
50%	0.286735	0.000000	9.900000	0.000000	0.538000	6.209000	78.200000	3.122200	5.000000	337.000000	19.000000	390.955000	11.570000
75%	3.731923	12.500000	18.100000	0.000000	0.631000	6.630000	94.100000	5.100400	24.000000	666.000000	20.200000	395.630000	17.102500
max	73.534100	100.000000	27.740000	1.000000	0.871000	8.780000	100.000000	12.126500	24.000000	711.000000	22.000000	396.900000	36.980000

Training Our Model

In [15]:
```
from sklearn.linear_model import LinearRegression
model = LinearRegression()
model.fit(training_data_new,training_labels)
```

Out[15]:
```
LinearRegression()
```

In [16]:
```
from sklearn.metrics import mean_squared_error
housing_predictions = model.predict(training_data_new)
mse = mean_squared_error(training_labels,housing_predictions)
rmse = np.sqrt(mse)
print(rmse)
```

```
4.835301058716238
```

CrossValidation Of Our Model

In [17]:
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(model,training_data_new,training_labels,scoring="neg_mean_squared_error",cv=10)
rmse_scores = np.sqrt(-scores)
rmse_scores
```

Out[17]:
```
array([4.22235612, 4.26438649, 5.09424333, 3.83081183, 5.37600331,
       4.41092152, 7.47272243, 5.48554135, 4.14606627, 6.0717752 ])
```

In [18]:
```
def print_scores(scores):
    print("Scores: ",scores)
    print("Mean: ",scores.mean())
    print("Standard Deviation: ",scores.std())
```

In [19]:
```
print_scores(rmse_scores)
```

```
Scores:  [4.22235612 4.26438649 5.09424333 3.83081183 5.37600331 4.41092152
 7.47272243 5.48554135 4.14606627 6.0717752 ]
Mean:  5.037482786117405
Standard Deviation:  1.0594382405606968
```

Testing Our Model

In [20]:
```
test_data = test_strat.drop("MEDV",axis=1)
test_labels = test_strat["MEDV"].copy()
final_test_data = imputer.transform(test_data)
test_predictions = model.predict(test_data)
final_mse = mean_squared_error(test_labels,test_predictions)
print(np.sqrt(final_mse))
```

```
4.143874870573352
```