TESLA Stock Prediction

Data Pre processing

Loading the dataset

In [1]:

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

In [2]:

```
df = pd.read_csv('TESLA.csv')
df
```

Out[2]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	30-06-2010	5.158000	6.084000	4.660000	4.766000	4.766000	85935500
1	01-07-2010	5.000000	5.184000	4.054000	4.392000	4.392000	41094000
2	02-07-2010	4.600000	4.620000	3.742000	3.840000	3.840000	25699000
3	06-07-2010	4.000000	4.000000	3.166000	3.222000	3.222000	34334500
4	07-07-2010	3.280000	3.326000	2.996000	3.160000	3.160000	34608500
...	...	...	...	...	...	...	...
2574	21-09-2020	453.130005	455.679993	407.070007	449.390015	449.390015	109476800
2575	22-09-2020	429.600006	437.760010	417.600006	424.230011	424.230011	79580800
2576	23-09-2020	405.160004	412.149994	375.880005	380.359985	380.359985	95074200
2577	24-09-2020	363.799988	399.500000	351.299988	387.790009	387.790009	96561100
2578	25-09-2020	393.470001	408.730011	391.299988	407.339996	407.339996	67068400

2579 rows × 7 columns

In [3]:

```
df.shape
```

Out[3]:

```
(2579, 7)
```

In [4]:

```
list(df.columns)
```

Out[4]:

```
['Date', 'Open', 'High', 'Low', 'Close', 'Adj Close', 'Volume']
```

In [5]:

```
# checking for null values
df.isnull().sum()
```

Out[5]:

```
Date          0
Open          0
High          3
Low           1
Close        16
Adj Close     0
Volume        0
dtype: int64
```

Handling the missing data

In [6]:

```
df1 = df.copy()
```

Using forward fill(ffill) and backward fill(bfill) methods to handle the missing values

In [7]:

```
df1['Close'].fillna(method = 'ffill',inplace = True)
df1.head(5)
```

Out[7]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	30-06-2010	5.158	6.084	4.660	4.766	4.766	85935500
1	01-07-2010	5.000	5.184	4.054	4.392	4.392	41094000
2	02-07-2010	4.600	4.620	3.742	3.840	3.840	25699000
3	06-07-2010	4.000	4.000	3.166	3.222	3.222	34334500
4	07-07-2010	3.280	3.326	2.996	3.160	3.160	34608500

In [8]:

```
df1['High'].fillna(method = 'bfill',inplace = True)
df1.head(5)
```

Out[8]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	30-06-2010	5.158	6.084	4.660	4.766	4.766	85935500
1	01-07-2010	5.000	5.184	4.054	4.392	4.392	41094000
2	02-07-2010	4.600	4.620	3.742	3.840	3.840	25699000
3	06-07-2010	4.000	4.000	3.166	3.222	3.222	34334500
4	07-07-2010	3.280	3.326	2.996	3.160	3.160	34608500

Droping a missing value row from the dataset

In [9]:

```
df1.dropna(axis=0,inplace=True)
df1.head(5)
```

Out[9]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	30-06-2010	5.158	6.084	4.660	4.766	4.766	85935500
1	01-07-2010	5.000	5.184	4.054	4.392	4.392	41094000
2	02-07-2010	4.600	4.620	3.742	3.840	3.840	25699000
3	06-07-2010	4.000	4.000	3.166	3.222	3.222	34334500
4	07-07-2010	3.280	3.326	2.996	3.160	3.160	34608500

In [10]:

```
df1.isnull().sum()
```

Out[10]:

```
Date         0
Open         0
High         0
Low          0
Close        0
Adj Close    0
Volume       0
dtype: int64
```

In [11]:

```
df1.describe()
```

Out[11]:

	Open	High	Low	Close	Adj Close	Volume
count	2578.000000	2578.000000	2578.000000	2578.000000	2578.000000	2.578000e+03
mean	49.223318	50.318884	48.089339	49.269635	49.269925	3.079309e+07
std	57.939183	59.893721	55.857108	58.125128	58.124909	2.855732e+07
min	3.228000	3.326000	2.996000	3.160000	3.160000	5.925000e+05
25%	7.175000	7.279500	6.990500	7.190500	7.190500	1.052762e+07
50%	44.015999	44.667999	43.314999	43.924000	43.924000	2.413700e+07
75%	59.339500	60.172500	57.841499	59.030001	59.030001	3.981350e+07
max	502.140015	502.489990	470.510010	498.320007	498.320007	3.046940e+08

In [12]:

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 2578 entries, 0 to 2578
Data columns (total 7 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   Date       2578 non-null   object 
 1   Open       2578 non-null   float64
 2   High       2578 non-null   float64
 3   Low        2578 non-null   float64
 4   Close      2578 non-null   float64
 5   Adj Close  2578 non-null   float64
 6   Volume     2578 non-null   int64  
dtypes: float64(5), int64(1), object(1)
memory usage: 161.1+ KB
```

Removing the Unwanted data (Data Reduction)

In [13]:

```
df1=df1.drop(['Date'], axis=1)
df1
```

Out[13]:

	Open	High	Low	Close	Adj Close	Volume
0	5.158000	6.084000	4.660000	4.766000	4.766000	85935500
1	5.000000	5.184000	4.054000	4.392000	4.392000	41094000
2	4.600000	4.620000	3.742000	3.840000	3.840000	25699000
3	4.000000	4.000000	3.166000	3.222000	3.222000	34334500
4	3.280000	3.326000	2.996000	3.160000	3.160000	34608500
...	...	...	...	...	...	...
2574	453.130005	455.679993	407.070007	449.390015	449.390015	109476800
2575	429.600006	437.760010	417.600006	424.230011	424.230011	79580800
2576	405.160004	412.149994	375.880005	380.359985	380.359985	95074200
2577	363.799988	399.500000	351.299988	387.790009	387.790009	96561100
2578	393.470001	408.730011	391.299988	407.339996	407.339996	67068400

2578 rows × 6 columns

Removing Outliers from the data

In [14]:

```
from scipy import stats
z = np.abs(stats.zscore(df1))
z
```

Out[14]:

```
array([[0.7606919 , 0.73869958, 0.77765868, 0.76580078, 0.76580866,
        1.93131224],
       [0.76341943, 0.75372911, 0.78850989, 0.77223642, 0.77224432,
        0.36077986],
       [0.77032456, 0.76314762, 0.79409666, 0.78173502, 0.78174296,
        0.17841589],
       ...,
       [6.14447292, 6.04239146, 5.86951728, 5.69727058, 5.69728706,
        2.25138682],
       [5.43048218, 5.83114314, 5.42938017, 5.82512347, 5.82514043,
        2.30346413],
       [5.94267044, 5.98527953, 6.14563209, 6.16153184, 6.16155007,
        1.27050938]])
```

In [15]:

```
threshold = 4
print(np.where(z > 4))
```

```
(array([ 721,  764,  844,  918, 2039, 2076, 2345, 2346, 2396, 2405, 2411,
       2413, 2414, 2415, 2416, 2462, 2475, 2520, 2521, 2523, 2523, 2523,
       2523, 2524, 2524, 2524, 2524, 2524, 2524, 2525, 2525, 2525, 2525,
       2525, 2526, 2526, 2526, 2526, 2526, 2527, 2527, 2527, 2527, 2527,
       2528, 2528, 2528, 2528, 2528, 2529, 2529, 2529, 2529, 2529, 2530,
       2530, 2530, 2530, 2530, 2531, 2531, 2531, 2531, 2531, 2532, 2532,
       2532, 2532, 2532, 2533, 2533, 2533, 2533, 2533, 2534, 2534, 2534,
       2534, 2534, 2535, 2535, 2535, 2535, 2535, 2536, 2536, 2536, 2536,
       2536, 2537, 2537, 2537, 2537, 2537, 2538, 2538, 2538, 2538, 2538,
       2539, 2539, 2539, 2539, 2539, 2540, 2540, 2540, 2540, 2540, 2541,
       2541, 2541, 2541, 2541, 2542, 2542, 2542, 2542, 2542, 2543, 2543,
       2543, 2543, 2543, 2544, 2544, 2544, 2544, 2544, 2545, 2546, 2546,
       2546, 2546, 2546, 2547, 2547, 2547, 2547, 2547, 2548, 2548, 2548,
       2548, 2548, 2549, 2549, 2549, 2549, 2549, 2550, 2550, 2550, 2550,
       2550, 2551, 2551, 2551, 2551, 2551, 2552, 2552, 2552, 2552, 2552,
       2553, 2553, 2553, 2553, 2553, 2554, 2554, 2554, 2554, 2554, 2555,
       2555, 2555, 2555, 2555, 2556, 2556, 2556, 2556, 2556, 2557, 2557,
       2557, 2557, 2557, 2558, 2558, 2558, 2558, 2558, 2559, 2559, 2559,
       2559, 2559, 2560, 2560, 2560, 2560, 2560, 2561, 2561, 2561, 2561,
       2561, 2562, 2562, 2562, 2562, 2562, 2563, 2563, 2563, 2563, 2563,
       2564, 2564, 2564, 2564, 2564, 2565, 2565, 2565, 2565, 2565, 2566,
       2566, 2566, 2566, 2566, 2567, 2567, 2567, 2567, 2567, 2568, 2568,
       2568, 2568, 2568, 2569, 2569, 2569, 2569, 2569, 2570, 2570, 2570,
       2570, 2570, 2571, 2571, 2571, 2571, 2571, 2572, 2572, 2572, 2572,
       2572, 2573, 2573, 2573, 2573, 2573, 2574, 2574, 2574, 2574, 2574,
       2575, 2575, 2575, 2575, 2575, 2576, 2576, 2576, 2576, 2576, 2577,
       2577, 2577, 2577, 2577], dtype=int64), array([5, 5, 5, 5, 5, 5, 5, 5,
5, 5, 5, 5, 5, 5, 5, 5, 5, 0, 0, 1, 2, 3,
       4, 0, 1, 2, 3, 4, 5, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4,
       0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1,
       2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3,
       4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0,
       1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 2, 0, 1,
       2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3,
       4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0,
       1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2,
       3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4,
       0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1,
       2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3,
       4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 0,
       1, 2, 3, 4], dtype=int64))
```

In [16]:

```
z[722][4]
```

Out[16]:

```
0.5558407207564203
```

Bin method to smooth the data

In [17]:

```
min_val=df1['Open'].min()
max_val=df1['Open'].max()
```

In [18]:

```
bins = np.linspace(min_val,max_val,50)
labels = bins[1:]
```

In [19]:

```
df1['Open_bin']=pd.cut(df1['Open'],bins=bins,labels=labels,include_lowest=True)
df1.head(5)
```

Out[19]:

	Open	High	Low	Close	Adj Close	Volume	Open_bin
0	5.158	6.084	4.660	4.766	4.766	85935500	13.409878
1	5.000	5.184	4.054	4.392	4.392	41094000	13.409878
2	4.600	4.620	3.742	3.840	3.840	25699000	13.409878
3	4.000	4.000	3.166	3.222	3.222	34334500	13.409878
4	3.280	3.326	2.996	3.160	3.160	34608500	13.409878

Plotting Heat map

In [20]:

```
import seaborn as sns
sns.heatmap(df1.corr(),annot=True,cmap="Blues")
```

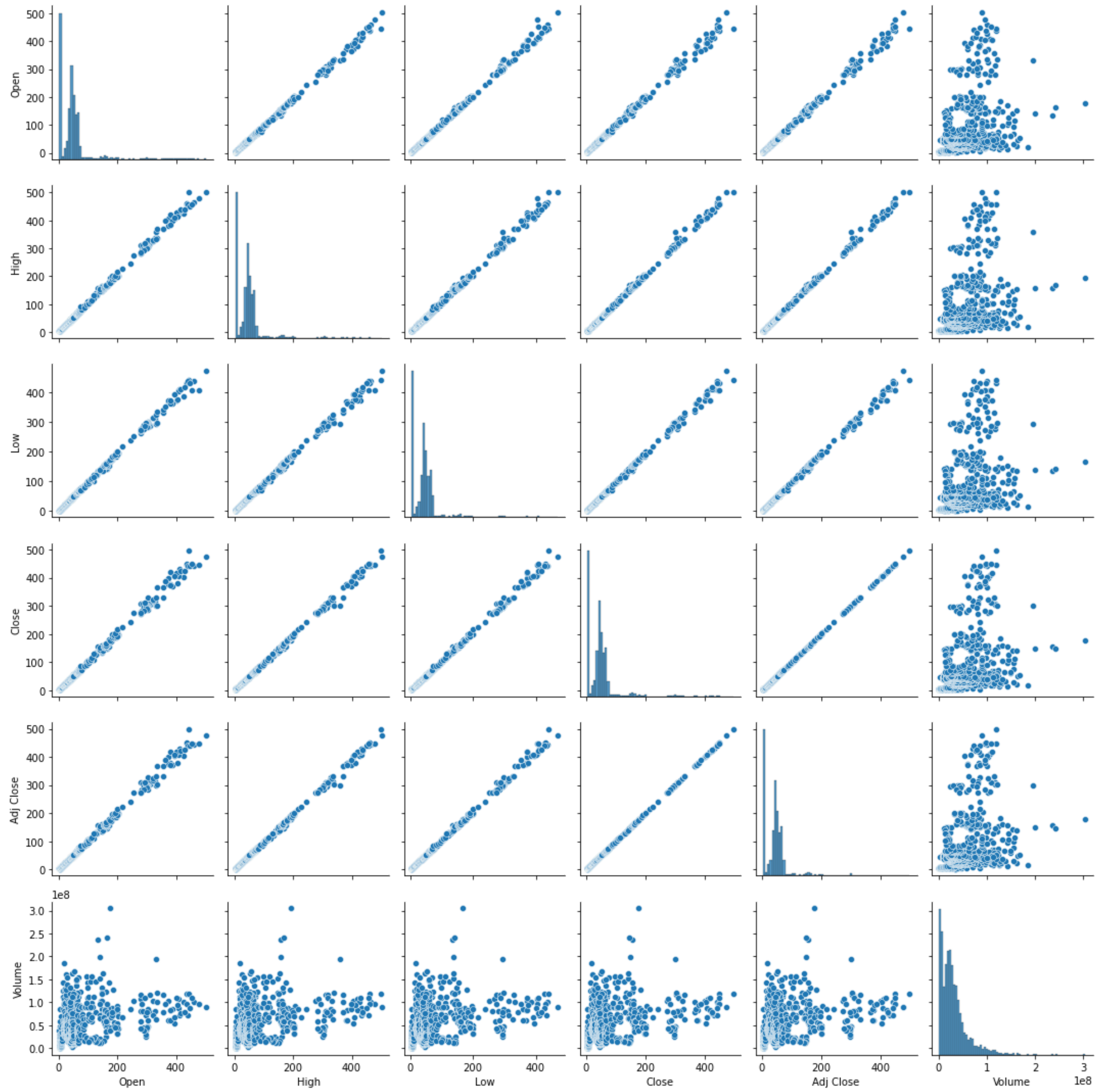
Out[20]:

```
<AxesSubplot:>
```

Plotting pair plots

In [21]:

```
import matplotlib.pyplot as plt
sns.pairplot(df1)
plt.tight_layout()
```



Model Training

Splitting data into test and train

In [22]:

```
X = df1[['High','Low','Open','Volume']].values
y = df1['Close'].values
```

In [23]:

```
X
```

Out[23]:

```
array([[6.08400000e+00, 4.66000000e+00, 5.15800000e+00, 8.59355000e+07],
       [5.18400000e+00, 4.05400000e+00, 5.00000000e+00, 4.10940000e+07],
       [4.62000000e+00, 3.74200000e+00, 4.60000000e+00, 2.56990000e+07],
       ...,
       [4.12149994e+02, 3.75880005e+02, 4.05160004e+02, 9.50742000e+07],
       [3.99500000e+02, 3.51299988e+02, 3.63799988e+02, 9.65611000e+07],
       [4.08730011e+02, 3.91299988e+02, 3.93470001e+02, 6.70684000e+07]])
```

In [24]:

```
y
```

Out[24]:

```
array([  4.766   ,   4.392   ,   3.84    , ..., 380.359985, 387.790009,
       407.339996])
```

In [25]:

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
```

In [26]:

```
X_train, X_test, y_train, y_test = train_test_split(X,y, test_size=0.3, random_state=1)
```

Applying Linear regression model

In [27]:

```
regressor = LinearRegression()
```

In [28]:

```
regressor.fit(X_train, y_train)
```

Out[28]:

```
LinearRegression()
```

In [29]:

```
print(regressor.coef_)
```

```
[ 8.86529434e-01  5.90674943e-01 -4.80488089e-01 -9.12309553e-09]
```

In [30]:

```
print(regressor.intercept_)
```

```
0.18305890812803938
```

In [31]:

```python
predicted = regressor.predict(X_test)
```

In [32]:

```python
print(predicted)
```

```
[ 37.47880929   5.38807108  34.50880414   6.63598077  46.11418883
  40.76209273  40.97394457  24.21181854  50.74840802  43.01086546
  42.37561648  38.92521974   6.97404288  43.92933482  54.54841911
   4.63582001  49.53543886  62.25558536   6.5381177   50.87690464
 162.24133816  77.99593083  24.27468256  17.50881428  67.52839045
  44.83030713  72.84314906  49.06348178  74.30292517  40.36710847
  50.69504816  29.41066589  52.14957192  47.6289346   34.35211649
  42.03609716  62.70286916   4.33418518  69.56965268  27.583481
  70.82663997  38.24743374  31.23889337  37.86178757  24.83811587
  39.15531042   3.43780217  39.68734374   7.59546828  51.70322833
   3.94365477   5.87377427   3.00958035  40.98947186  50.87890254
   7.31026091   7.27879561  50.02336588 449.69287717   8.44143851
 130.87623197  47.09748832  70.11110321  41.81836048  69.90096233
  55.78132463 126.84015587  64.01681455  48.65375992  67.92636612
   4.96917532 155.00578391  40.66018723  58.69752658   6.81353267
  35.96521108  34.89655794   5.56077588  53.94525246  59.68101341
   5.71250727  72.53416046  56.54920711  38.5814036    5.50461587
  42.66971426  10.00943872   4.21675798  43.81842646  39.74271786
  46.7223725    5.75923484   4.1613254    4.80713968  53.52019968
```

In [33]:

```python
data1 = pd.DataFrame({'Actual': y_test.flatten(), 'Predicted' : predicted.flatten()})
```

In [34]:

```
data1.head(20)
```

Out[34]:

	Actual	Predicted
0	36.903999	37.478809
1	5.278000	5.388071
2	35.066002	34.508804
3	6.454000	6.635981
4	45.816002	46.114189
5	41.080002	40.762093
6	40.807999	40.973945
7	24.454000	24.211819
8	50.478001	50.748408
9	43.495998	43.010865
10	42.018002	42.375616
11	39.821999	38.925220
12	7.032000	6.974043
13	43.720001	43.929335
14	53.790001	54.548419
15	4.590000	4.635820
16	49.599998	49.535439
17	62.924000	62.255585
18	6.454000	6.538118
19	51.400002	50.876905

In [35]:

```
from sklearn import preprocessing
from sklearn import metrics
```

Calculating the Accuracy and Errors

In [37]:

```
from sklearn.metrics import r2_score
print("Accuracy score of the predictions: {0}".format(r2_score(y_test, predicted.flatten()))
```

```
Accuracy score of the predictions: 0.999700595009277
```

In [38]:

```
import math
print('Mean Absolute Error:', metrics.mean_absolute_error(y_test,predicted))
print('Mean Squared Error:', metrics.mean_squared_error(y_test,predicted))
print('Root Mean Squared Error:', math.sqrt(metrics.mean_squared_error(y_test,predicted)))
```

```
Mean Absolute Error: 0.4513383670769388
Mean Squared Error: 0.8312963055576927
Root Mean Squared Error: 0.9117545204481812
```

In [39]:

```
graph = data1.head(20)
```

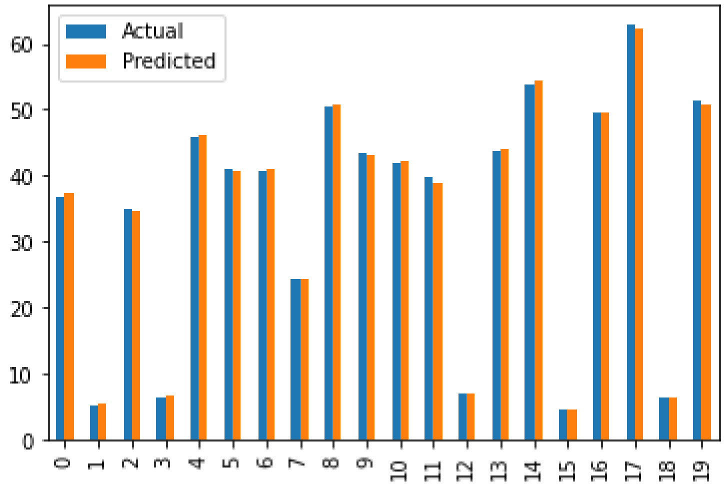
Plotting bar graph for the actual values vs predicted values

In [40]:

```
graph.plot(kind='bar')
```

Out[40]:

```
<AxesSubplot:>
```



In [ ]: