

multiple\_linear\_regression - Jupyter | sklearn.compose.ColumnTransformer | +

localhost:8890/notebooks/Linear%20Regression/multiple\_linear\_regression.ipynb

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## Multiple Linear Regression

### Importing the libraries

```
In [1]: import numpy as np
import pandas as pd
```

### Creating the dataset

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4$$

```
In [2]: from numpy.random import rand
df = pd.DataFrame(rand(50, 3)*10, columns = 'Hours_studied Hours_slept IQ '.split())
```

```
In [3]: from random import choice
location = []
for i in range(50):
    location.append(choice(["New Delhi", "Pune", "Bangalore"]))
```

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22:28 16-05-2021 ENG

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Creating the dataset

```
y = b0 + b1*x1 + b2*x2 + b3*x3 + b4*x4
```

```
from numpy.random import rand
```

```
rand(50, 3)
```

```
array([[0.26482311, 0.42048818, 0.06245756],  
       [0.23987578, 0.60179504, 0.01704272],  
       [0.8110481 , 0.45547791, 0.02804878],  
       [0.83616478, 0.95758122, 0.74611957],  
       [0.70843578, 0.4838355, 0.85991823],  
       [0.94609902, 0.18811667, 0.01929951],  
       [0.83434913, 0.919946 , 0.38277281],  
       [0.49828075, 0.27225181, 0.28716815],  
       [0.97289275, 0.15155228, 0.71858541],  
       [0.32695481, 0.25345181, 0.53351823],  
       [0.45293822, 0.56165184, 0.2451927 ],  
       [0.43869901, 0.87258235, 0.59968807],  
       [0.38646715, 0.94341519, 0.3291581 ],  
       [0.63943921, 0.65195518, 0.00990799],  
       [0.48916394, 0.85328839, 0.05722286],  
       [0.52714841, 0.56795084, 0.9123536 ],  
       [0.11489338, 0.51629767, 0.45979189],  
       [0.3836509 , 0.78757835, 0.40906973],  
       [0.83070547, 0.62111061, 0.04332322],  
       [0.22488695, 0.55557653, 0.34233989],
```

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```
1 import numpy as np
2 import pandas as pd
```

Creating the dataset

```
3 y = b0 + b1*x1 + b2*x2 + b3*x3 + b4*x4
4
```

In [10]:

```
1 from numpy.random import rand
2
3 rand( 50 , 3)*10
```

```
array([[ 9.4304245,  4.54340605,  6.19893896],
       [ 0.35901952,  0.7714229 ,  7.99497747],
       [ 0.51904455,  5.07286298,  6.00497683],
       [ 6.9357253 ,  9.84963129,  1.12512601],
       [ 7.63128179,  1.2537008 ,  2.36083497],
       [ 8.50074104,  7.59628862,  2.94052124],
       [ 4.91885679,  9.09850255,  4.36710373],
       [ 5.69850342,  6.71898254,  0.40724568],
       [ 6.00701159,  2.68087904,  8.35489194],
       [ 0.30260342,  0.0504552,  7.6909245 ],
       [ 4.50303607,  6.9668495 ,  6.00137969],
       [ 5.73406403,  0.4411772 ,  9.63908022],
       [ 3.92745952,  9.97807612,  6.25731528],
       [ 7.40906626,  2.80956482,  9.35146345],
       [ 8.68905475,  2.32901604,  4.89924683],
       [ 5.54804181,  5.05382524,  7.91973351],
```

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

Creating the dataset

```
y = b0 + b1*x1 + b2*x2 + b3*x3 + b4*x4
```

```
from numpy.random import rand
np.set_printoptions(precision=2)
rand( 50 , 3)*10
```

```
array([[3.99, 7.68, 7.83],
       [0.28, 8.86, 1.03],
       [4.06, 0.89, 9.24],
       [7.68, 1.3, 1.89],
       [5.56, 0.56, 4.73],
       [6.96, 9.5, 7.05],
       [2.19, 2.91, 1.81],
       [0.74, 3.49, 1.13],
       [7.06, 6.63, 4.09],
       [0.38, 5.17, 1.67],
       [4.73, 8.92, 4.14],
       [1.23, 0.66, 4.74],
       [2.02, 4.01, 5.25],
       [8.05, 0.73, 8.63]
```

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```
[9.58, 9.98, 3.97],  
[2.22, 5.51, 6.21],  
[1.42, 4.86, 8.93],  
[8.64, 1.06, 9.94],  
[7.91, 7.52, 1.82],  
[3.22, 9.35, 2.79],  
[6.41, 3.99, 1.18],  
[5.99, 2.42, 1.4 ],  
[7.83, 8.48, 9.98],  
[4.77, 4.94, 6.5 ],  
[5.94, 8.55, 9.6 ],  
[2.5 , 2.38, 8.12],  
[8.11, 8.82, 1.64]]
```

```
1 from numpy.random import rand  
2 df = pd.DataFrame(rand( 50 , 3)*10, columns = ['Hours_studied', 'Hours_slept', 'IQ '.split()])  
3
```

```
1 from random import choice  
2  
3 location = []  
4 for i in range(50):  
5     location.append(choice(["New Delhi" , "Pune" , "Bangalore"]))  
6  
7 df['location'] = location  
8
```

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Creating the dataset

```
y = b0 + b1*x1 + b2*x2 + b3*x3 + b4*x4
```

```
['Hours_studied', 'Hours_slept', 'IQ'].split(",")
```

```
['Hours_studied', 'Hours_slept', 'IQ']
```

```
from numpy.random import rand
df = pd.DataFrame(rand(50, 3)*10, columns = ['Hours_studied', 'Hours_slept', 'IQ'])
df.head()
```

	Hours_studied	Hours_slept	IQ
0	1.861195	7.964858	9.075683
1	0.882992	6.809651	5.014331
2	6.529097	7.474048	9.479220
3	6.487047	6.294339	8.660800
4	3.793140	4.324589	1.179682

```
from random import choice
```

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```
df.head(2)
```

	Hours_studied	Hours_slept	iQ
0	5.391181	3.953001	3.620444
1	5.490866	3.917476	3.691032

```
from random import choice

location = []
for i in range(50):
    location.append(choice(["New Delhi", "Pune", "Bangalore"]))

df['Location'] = location
df

df['Marks'] = (1.73 + (3.34*df['Hours_studied'])
              + (2.45*df['Hours_slept'])
              + (1.83*df['iQ'] ))
df['Marks'] = df['Marks'] + np.random.rand(50)*20

df.to_csv('Students.csv', index=False)
```

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```
for i in range(50):
    location.append(choice(["New Delhi", "Pune", "Bangalore"]))

df['Location'] = location

df.head()
```

	Hours_studied	Hours_slept	iQ	Location
0	4.191497	0.322225	4.567598	New Delhi
1	8.705079	7.070010	7.513174	Bangalore
2	1.260775	0.907799	8.482324	Pune
3	0.962609	7.838883	3.294534	Bangalore
4	9.769941	1.148227	3.277269	Pune

```
df['Marks'] = (1.73 + (3.34*df['Hours_studied'])
               + (2.45*df['Hours_slept'])
               + (1.83*df['iQ'] ))
df['Marks'] = df['Marks'] + np.random.rand(50)*20

df.to_csv('Students.csv', index=False)
```

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sklearn.compose.ColumnTransformer

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Python 3

4

9.789941 1.148227 3.277269 Pune

In [7]:

```
1 df['Marks'] = (1.73 + (3.34*df['Hours_studied'])
2               + (2.45*df['Hours_slept'])
3               + (1.83*df['IQ'] ))
4 df['Marks'] = df['Marks'] + np.random.rand(50)*20
5
6 df.to_csv('Students.csv',index=False)
7
```

In [8]:

```
1 df.head()
```

	Hours_studied	Hours_slept	iQ	Location	Marks
0	4.191497	0.322225	4.567596	New Delhi	38.306737
1	8.705079	7.070010	7.513174	Bangalore	81.536968
2	1.280775	0.907789	8.482324	Pune	24.854204
3	0.962609	7.838683	3.294534	Bangalore	47.321010
4	9.789941	1.148227	3.277269	Pune	51.274658

Importing the dataset

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sklearn.compose.ColumnTransformer

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Python 3

4

9.7899411.1482273.277269Pune

In [7]:

```
1 df['Marks'] = (1.73 + (3.34*df['Hours_studied'])
2               + (2.45*df['Hours_slept'])
3               + (1.83*df['IQ'] ))
4 df['Marks'] = df['Marks'] + np.random.rand(50)*20
5
6 df.to_csv('Students.csv',index=False)
7
```

In [8]:

```
1 df.head()
```

	Hours_studied	Hours_slept	iQ	Location	Marks
0	4.191497	0.322225	4.667596	New Delhi	38.306737
1	8.705079	7.070010	7.513174	Bangalore	81.536968
2	1.280775	0.907789	8.482324	Pune	24.854204
3	0.962609	7.838683	3.294534	Bangalore	47.321010
4	9.789941	1.148227	3.277269	Pune	51.274658

Importing the dataset

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```
In [10]: df.head()
```

	Hours_studied	Hours_slept	iQ	Location	Marks
0	4.191497	0.322225	4.567596	New Delhi	39.306737
1	8.705079	7.070010	7.513174	Bangalore	81.539968
2	1.260775	0.907799	8.482324	Pune	24.854204
3	0.962609	7.838883	3.294534	Bangalore	47.321010
4	9.789941	1.148227	3.277269	Pune	51.274858

### Importing the dataset

```
In [1]: dataset = pd.read_csv('Students.csv')
2
3 x = dataset.iloc[:, :-1].values
4 y = dataset.iloc[:, -1].values
5 print(X)
```

```
In [2]: #print(X)
```

### Encoding categorical data

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A B  
C D

	A	B	C	D
A	0000	0000	0000	0000
B	0000	0000	0000	0000
C	0000	0000	0000	0000
D	0000	0000	0000	0000

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Out[12]:

```
print(y)
```

[38.30873724 81.53996779 24.85420373 47.32101008 51.27605846 44.136174  
24.63450230 41.43690017 57.32627002 56.03012224 54.54201583 36.66249071  
39.75550985 58.65748628 39.9491065 33.13787952 40.07693671 36.00185785  
64.62683638 67.61014318 61.60418802 35.79032583 62.72016848 72.05213616  
72.79466956 38.25806213 55.63883925 29.23523221 54.1062413 55.53555088  
50.74643373 32.02302405 66.18796234 57.01417165 53.80017911 81.51046661  
24.40791339 48.58351413 60.06488766 64.99963389 52.8236103 33.22414355  
32.42263998 44.91510102 41.65418209 39.98662794 50.65013645 49.63725279  
49.89578541 63.05442362]

Encoding categorical data

In[13]:

```
from sklearn.compose import ColumnTransformer  
from sklearn.preprocessing import OneHotEncoder  
ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [3])], remainder='passthrough')  
print(ct)  
X = np.array(ct.fit_transform(X))
```

In[14]:

```
print(X)
```

Splitting the dataset into the Training set and Test set

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### Encoding categorical data

```
1 from sklearn.compose import ColumnTransformer
2 from sklearn.preprocessing import OneHotEncoder
3 ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [3])], remainder='passthrough')
4 print(ct)
5 X = np.array(ct.fit_transform(X))
```

ColumnTransformer(remainder='passthrough', transformers=[('encoder', OneHotEncoder(), [3])])

```
1 print(X)
```

```
[[0.0 1.0 0.0 0.191097161875661 0.3222248864988222 8.5675958259229665]
 [1.0 0.0 0.0 0.705072596550537 7.0708104022835125 7.513173785075537]
 [0.0 0.0 1.0 1.2607751801420343 0.9077986647578028 8.482324450975123]
 [1.0 0.0 0.0 0.9629892548140899 7.83882960020305 3.2045340687582567]
 [0.0 0.0 1.0 9.78994875450852 1.1482273086395944 3.777269197736867]
 [1.0 0.0 0.0 6.239809134587276 1.410800236957429 2.9167186157427563]
 [1.0 0.0 0.0 0.6378647313996476 6.761674032651995 0.6844540237985523]
 [0.0 0.0 1.0 3.4435782744916336 0.645320405836733 8.753094165270531]
 [0.0 1.0 0.0 4.052208789548332 8.38450881106263 5.4981615757405122]
 [0.0 1.0 0.0 0.631492830187771 3.936415856713413 4.478226422012634]
 [0.0 0.0 1.0 4.641796255045204 6.22245609847972 0.7486075370057132]
 [1.0 0.0 0.0 6.087494481343639 0.2148394401581379 0.17206374727057940]
 [0.0 0.0 1.0 0.9823089166715508 3.510413464358317 6.062543009450563]
 [1.0 0.0 0.0 0.609138655310055 5.12833866062800 7.4928653803167131]]
```

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```
24.40191339 48.58353413 60.06488706 64.99963389 52.8236103 33.22414355
32.42263998 44.93518102 41.65418209 39.98662704 50.65013645 49.63725279
49.89578541 63.05442362]
```

### Encoding categorical data

```
1 from sklearn.compose import ColumnTransformer
2 from sklearn.preprocessing import OneHotEncoder
3 ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [3])])
4 print(ct)
5 X = np.array(ct.fit_transform(X))
```

ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [3])])

```
1 print(X)
```

```
(0, 18) 1.0
(1, 43) 1.0
(2, 4) 1.0
(3, 3) 1.0
(4, 88) 1.0
(5, 26) 1.0
(6, 1) 1.0
(7, 10) 1.0
(8, 15) 1.0
(9, 42) 1.0
```

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## Encoding categorical data

```
In [18]: from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [3])], remainder='passthrough')
print(ct)
X = np.array(ct.fit_transform(X))
```

ColumnTransformer(remainder='passthrough', transformers=[('encoder', OneHotEncoder(), [3])])

```
In [19]: print(X)
```

```
[[0.0 0.0 1.0 7.115804517913477 4.4292087242718195 6.438381702862820]
[1.0 0.0 0.0 4.735717787946581 1.7947171710337211 3.276297991346122]
[1.0 0.0 0.0 5.10131852786702 7.8079640343803673 7.1697088475489175]
[0.0 1.0 0.0 0.96804762900432338 0.81885805131068205 4.192623705645725]
[0.0 0.0 1.0 6.929804554601426 5.636895327264181 1.0556174816778882]
[0.0 1.0 0.0 3.473845662547924 5.814200051988352 6.373677344768778]
[0.0 1.0 0.0 9.63026814624871 3.5880822708487368 8.368520380371046]
[0.0 1.0 0.0 1.5835492389912542 0.368787834830956 0.5697386081058778]
[0.0 0.0 1.0 1.182353400610007 3.2945333348901083 5.59520243589838]
[1.0 0.0 0.0 2.0935281713678112 0.5517413768602586 1.0446514232635795]
[0.0 1.0 0.0 7.531928663174112 4.182208296178672 7.073405388865365]
[0.0 0.0 1.0 5.498322564328314 7.614732476208675 1.8942666802578785]
[0.0 1.0 0.0 2.7284936758159534 3.9276658590994844 3.2845369224418265]]
```

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```
[0.0 0.0 1.0 5.850781230004813 3.416031881219661 1.382572074508079]
[1.0 0.0 0.0 5.847926783751409 0.884378144480040 4.841265340246701]
[1.0 0.0 0.0 7.877487545388078 9.104246252896726 1.8889310626664972]
[1.0 0.0 0.0 5.328073688378532 5.483801776472436 4.349328450583024]
[1.0 0.0 0.0 6.0540799356263875 5.923714847238579 9.06606069241124]
[1.0 0.0 0.0 2.1954817509384274 8.1047546379348489 2.5888774263929606]
[0.0 1.0 0.0 0.04581292663467367 8.068208351535137 4.378085276709475]
[0.0 1.0 0.0 3.6452686539320302 0.2157387280764609 2.5563668736348963]]
```

### Splitting the dataset into the Training set and Test set

```
1 from sklearn.model_selection import train_test_split
2 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)
3 y_test
```

### Training the Multiple Linear Regression model on the Training set

```
1 from sklearn.linear_model import LinearRegression
2 regressor = LinearRegression()
3 regressor.fit(X_train, y_train)
```

### Predicting the Test set results

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```
[0.0 0.0 1.0 5.856781230681813 3.416031881219661 1.382572074508679]
[1.0 0.0 0.0 5.847676783751409 0.884378144480040 4.841265346246701]
[1.0 0.0 0.0 7.877487545388078 9.104246252896726 1.8889310626664972]
[1.0 0.0 0.0 5.328073688378532 5.483801776472436 4.349328452583824]
[1.0 0.0 0.0 6.0540799356263875 5.923714847238579 9.06686869241124]
[1.0 0.0 0.0 2.1954817509384274 8.147546379148489 2.588874263929606]
[0.0 1.0 0.0 0.04541292663467367 8.068208351515137 4.378085276709475]
[0.0 1.0 0.0 3.6452686539320302 0.2157387260764609 2.5563668736348963]]
```

Splitting the dataset into the Training set and Test set

```
In [198]: 1 from sklearn.model_selection import train_test_split
          2 X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 0)
          3 y_test
```

array([35.8829665, 43.93285329, 63.67895293, 46.25878743, 51.49285684,
 55.70150517, 57.87212943, 41.98178412, 35.96885173, 50.40149434])

Training the Multiple Linear Regression model on the Training set

```
In [199]: 1 from sklearn.linear_model import LinearRegression
          2 regressor = LinearRegression()
          3 regressor.fit(X_train, y_train)
```

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22:54  
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multiple\_linear\_regression - Jupyter x sklearn.compose.ColumnTransformer x +

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```
[20]: y_pred = regressor.predict(X_test)

np.set_printoptions(precision=2)
print("\n\nPredicted Actual")
print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))
```

Predicted Actual

[44.53	35.81]
[51.77	43.93]
[62.34	63.67]
[52.2	46.20]
[52.02	53.49]
[60.08	55.2]
[46.33	57.67]
[46.09	41.98]
[47.36	35.97]
[51.87	50.4]

```
[20]: y_pred
```

array([44.52618797, 51.7724811, 62.33791431, 52.09679762, 62.22076811,  
60.0804027, 52.22706782, 46.00201649, 52.19899461, 51.96017371])

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## Multiple Linear Regression

### Importing the libraries

```
1 import numpy as np
2 import pandas as pd
```

### Creating the dataset

```
1 y = b0 + b1*x1 + b2*x2 + b3*x3 + b4*x4
2
```

```
1 from numpy.random import rand
2
3 df = pd.DataFrame(rand( 50 , 3)*10, columns = 'Hours_studied Hours_slept iq '.split())
4 df.head(2)
```

```
1 from random import choice
2
3 location = []
4 for i in range(50):
```

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```
2
3 df = pd.DataFrame(rand( 50 , 3)*10, columns = 'Hours_studied Hours_slept iq '.split())
4 df.head(2)
```

Out[1]:

```
1 from random import choice
2
3 location = []
4 for i in range(50):
5     location.append(choice(["New Delhi" , "Pune" , "Bangalore"]))
6
7
8 df['Location'] = location
9
10 df.head()
```

Out[1]:

```
1 df['Marks'] = (1.73 + (3.34*df['Hours_studied'])
2               + (2.45*df['Hours_slept'])
3               + (1.83*df['iq'] ))
4 df['Marks'] = df['Marks'] + np.random.rand(50)*20
5
6 df.to_csv('Students.csv',index=False)
7
```

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```
location = []
for i in range(50):
    location.append(choice(["New Delhi", "Pune", "Bangalore"]))

df['location'] = location

df.head()
```

```
df['Marks'] = (1.73 + (3.34*df['Hours_studied'])
              + (2.45*df['Hours_slept'])
              + (1.65*df['IQ']))
df['Marks'] = df['Marks'] + np.random.rand(50)*20

df.to_csv('Students.csv', index=False)
```

```
df.head()
```

Importing the dataset

```
dataset = pd.read_csv('Students.csv')
```

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```
df['Marks'] = df['Marks'] + np.random.rand(50)*20
df.to_csv('Students.csv', index=False)
```

df.head()

### Importing the dataset

```
dataset = pd.read_csv('Students.csv')
X = dataset.iloc[:, :-1].values
y = dataset.iloc[:, -1].values
print(X)
```

```
print(y)
```

### Encoding categorical data

```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
```

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### Encoding categorical data

```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder
ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [3])], remainder='passthrough')
print(ct)
X = np.array(ct.fit_transform(X))

print(X)
```

### Splitting the dataset into the Training set and Test set

```
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 = 0)
y_test
```

### Training the Multiple Linear Regression model on the Training set

```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

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y\_test

### Training the Multiple Linear Regression model on the Training set

```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

### Predicting the Test set results

```
y_pred = regressor.predict(X_test)

np.set_printoptions(precision=2)
print("\n\nPredicted Actual")
print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))
```

```
np.set_printoptions(precision=2)
print(np.concatenate((X_test, y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))
```

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```
from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
regressor.fit(X_train, y_train)
```

### Predicting the Test set results

```
y_pred = regressor.predict(X_test)

np.set_printoptions(precision=2)
print("\n\nPredicted Actual")
print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))
```

```
np.set_printoptions(precision=2)
print(np.concatenate((X_test ,y_pred.reshape(len(y_pred),1) ,y_test.reshape(len(y_test),1)) ,1))
```

```
len(y_pred)
```

```
y_test
```

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