D3_CrimeRate

August 9, 2018

1 Day-3 Use Case : Predicting Crime rate.

```
In [72]: import pandas as pd
         from sklearn import linear_model
         from sklearn.metrics import mean_squared_error,r2_score
         from sklearn.model_selection import train_test_split,cross_validate
         from math import sqrt
         import matplotlib.pyplot as plt
         import numpy as np
```

```
In [73]: df=pd.read_excel('Crime.xlsx')
```

1.0.1 Data Exploration

```
In [74]: df.info() # All are continous variables
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50 entries, 0 to 49
Data columns (total 7 columns):
X1    50 non-null int64
X2    50 non-null int64
X3    50 non-null int64
X4    50 non-null int64
X5    50 non-null int64
X6    50 non-null int64
X7    50 non-null int64
dtypes: int64(7)
memory usage: 2.8 KB
```

```
In [75]: df.describe() # Nothing abnormal to be found
```

```
Out[75]:                X1          X2         X3         X4         X5         X6  \
         count   50.000000   50.000000  50.000000  50.000000  50.000000  50.000000
         mean   717.960000  616.180000  37.760000  58.800000  15.400000  29.900000
         std    293.938766  573.739175  13.820364   9.965246   6.023762  14.801062
         min    341.000000   29.000000  16.000000  42.000000   4.000000   7.000000
         25%    497.000000  230.750000  30.000000  49.000000  11.000000  21.250000
```

```
50%     654.500000   454.000000  34.500000  59.000000  14.000000  25.000000
75%     820.500000   822.500000  42.250000  67.000000  19.000000  34.250000
max    1740.000000  3545.000000  86.000000  81.000000  34.000000  81.000000

              X7
count  50.000000
mean   13.820000
std     5.157479
min     8.000000
25%    11.000000
50%    12.000000
75%    15.750000
max    36.000000
```

```
In [76]: df.isna().sum()  # No Missing Values
```

```
Out[76]: X1    0
         X2    0
         X3    0
         X4    0
         X5    0
         X6    0
         X7    0
         dtype: int64
```

```
In [77]: x=df[df.columns[1:7]]
         y=df[df.columns[0]]
```

```
In [78]: df.columns[1:7]
```

```
Out[78]: Index(['X2', 'X3', 'X4', 'X5', 'X6', 'X7'], dtype='object')
```

```
In [79]: x.sample(10)
```

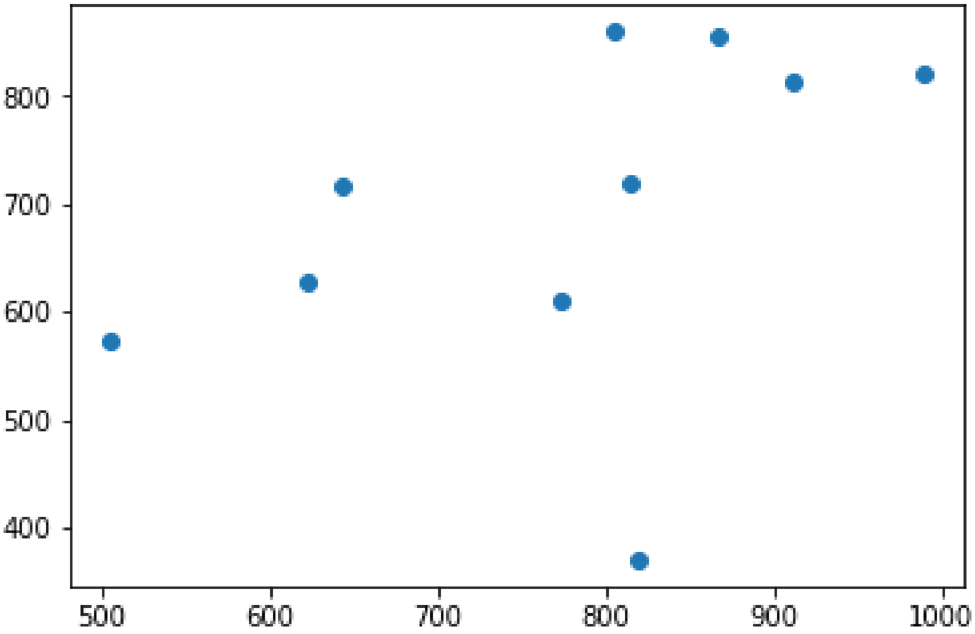
```
Out[79]:       X2  X3  X4  X5  X6  X7
         20   608  33  46  22  24   8
         8     38  36  69   7  25  12
         43   433  43  48  26  23  12
         2    347  57  70  18  16  16
         9    226  31  66   9  58  15
         48  1022  82  72  22  15  16
         49  1244  66  67  26  18  16
         29   216  36  43  18  23   8
         19    98  23  56  15  50  15
         25   693  35  57   9  60  18
```

1.0.2 Model Preparation

```
In [97]: def testmodel(x,y):
             x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.20,random_sta
             regr = linear_model.LinearRegression()
             regr.fit(x_train,y_train)
             y_pred_test=regr.predict(x_test)
             print("Root Mean squared error: %.4f"% sqrt(mean_squared_error(y_test,y_pred_test))
             print('R2 score: %.4f' % r2_score(y_test, y_pred_test))
             plt.scatter(y_test,y_pred_test)
```

```
In [98]: testmodel(x,y)                                   # Base model with all the variables.
```

```
Root Mean squared error: 169.7250
R2 score: -0.5133
```



Identifying Important Features

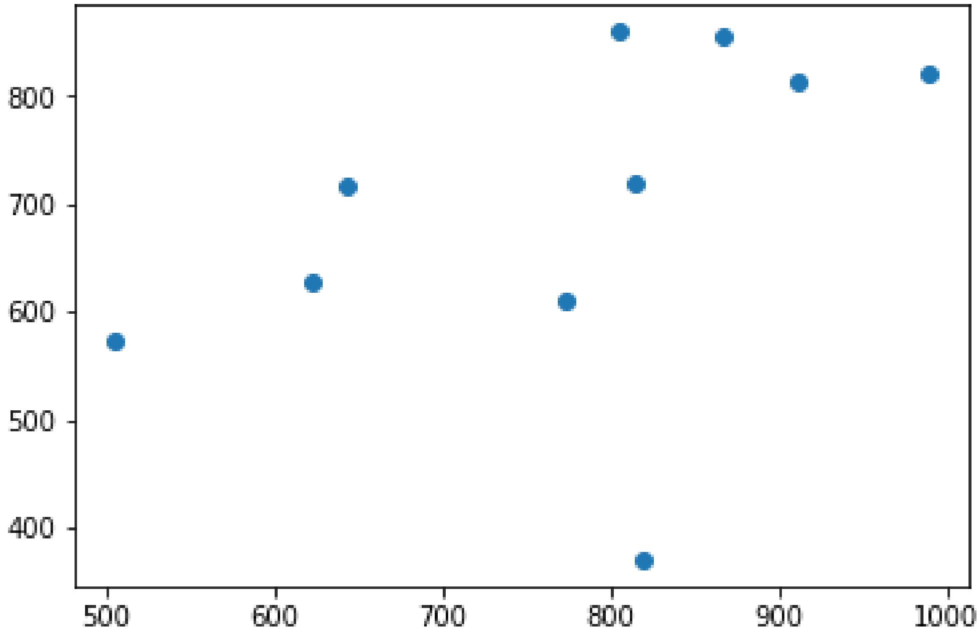
```
In [99]: df.corr()
```

```
Out[99]:           X1        X2        X3        X4        X5        X6        X7
         X1  1.000000  0.756505  0.533198 -0.135459  0.322519 -0.175224 -0.026283
         X2  0.756505  1.000000  0.509339 -0.184445  0.291031 -0.199070 -0.045570
         X3  0.533198  0.509339  1.000000  0.120265  0.311526 -0.277475  0.124502
         X4 -0.135459 -0.184445  0.120265  1.000000 -0.537162  0.182364  0.681072
         X5  0.322519  0.291031  0.311526 -0.537162  1.000000 -0.626953 -0.513958
         X6 -0.175224 -0.199070 -0.277475  0.182364 -0.626953  1.000000  0.591663
         X7 -0.026283 -0.045570  0.124502  0.681072 -0.513958  0.591663  1.000000
```

here X2,X3,X5,X6,X4,X7 are the order of importance of variables.

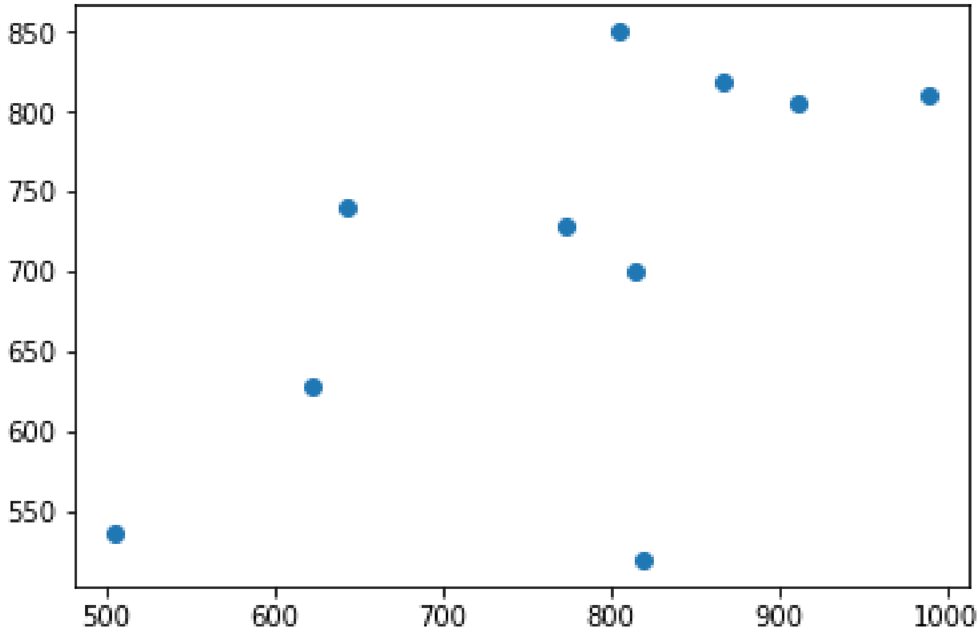
```
In [100]: testmodel(x[['X2','X3','X5','X6','X4','X7']],y)           # Base Model
```

```
Root Mean squared error: 169.7250
R2 score: -0.5133
```

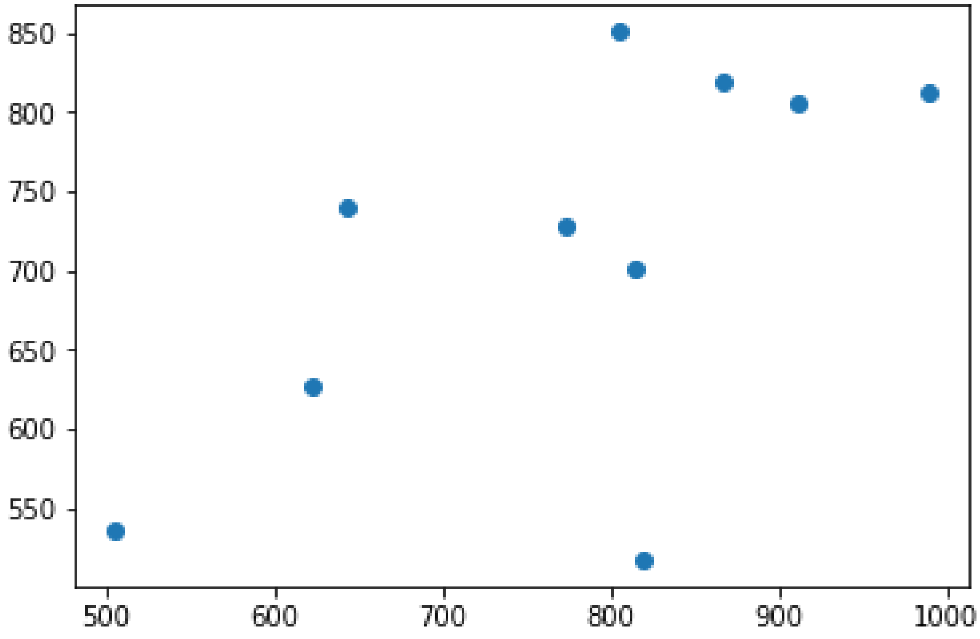


```
In [101]: testmodel(x[['X2','X3','X5','X6','X4']],y)                # Model without X7
```

```
Root Mean squared error: 127.5529
R2 score: 0.1453
```



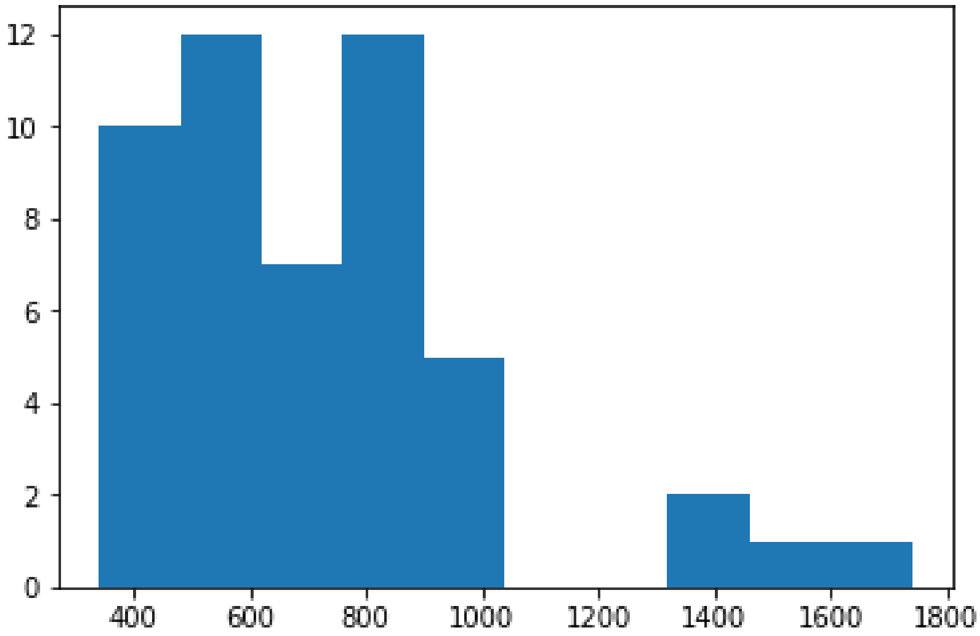
```
In [102]: testmodel(x[['X2','X3','X5','X6']],y)                    # Model without X4

Root Mean squared error: 127.7484
R2 score: 0.1427
```



Identifying Outliers and removing them from Data.

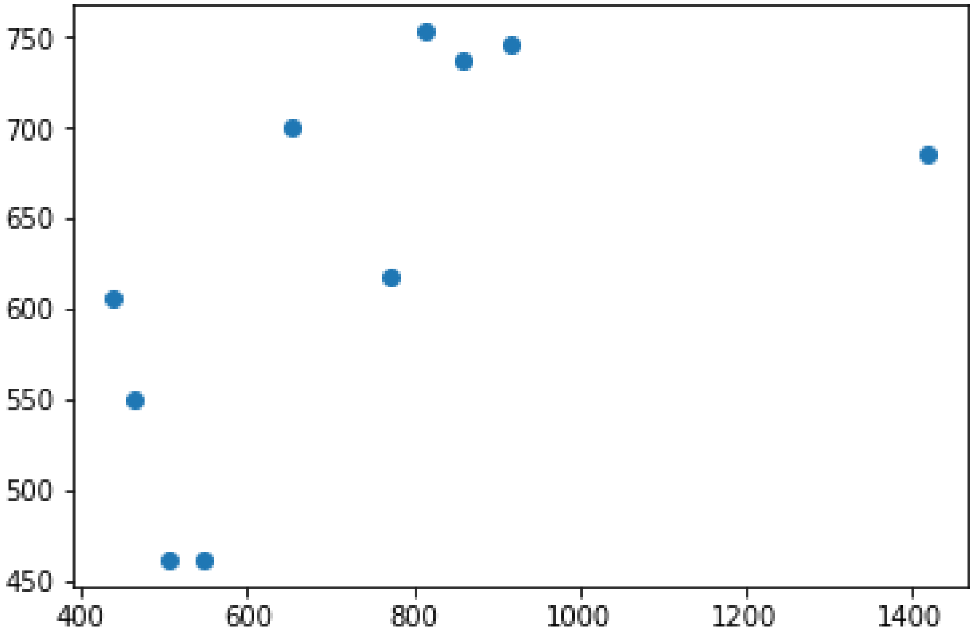
```
In [103]: y_new=np.array(y)
          plt.hist(y)
```

```
Out[103]: (array([10., 12.,  7., 12.,  5.,  0.,  0.,  2.,  1.,  1.]),
           array([ 341. ,  480.9,  620.8,  760.7,  900.6, 1040.5, 1180.4, 1320.3,
                  1460.2, 1600.1, 1740. ]),
           <a list of 10 Patch objects>)
```



```
In [104]: df_rm=df[df['X1']<(np.mean(y_new)+3*np.std(y_new))]
          x_rm=df_rm[df_rm.columns[1:7]]
          y_rm=df_rm[df_rm.columns[0]]
          testmodel(x_rm[['X2','X3','X5','X6']],y_rm)
```

```
Root Mean squared error: 256.5802
R2 score: 0.1581
```



Cross Validating the Dataset.

```
In [105]: regr=linear_model.LinearRegression()
          scores = cross_validate(regr, x_rm, y_rm,cv=10, scoring=['neg_mean_squared_error','r2'
          print(sqrt(-scores['test_neg_mean_squared_error'].mean()))
          print(scores['test_r2'].mean())
```

```
215.28213995577553
-2.431384329071694
```