06_Implement_SGD

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In [0]:
```
import warnings
warnings.filterwarnings("ignore")
from sklearn.datasets import load_boston
from random import seed
from random import randrange
from csv import reader
from math import sqrt
from sklearn import preprocessing
import pandas as pd
from sklearn.model_selection import train_test_split
import numpy as np
import matplotlib.pyplot as plt
from prettytable import PrettyTable
from sklearn.linear_model import SGDRegressor
from sklearn import preprocessing
from sklearn.metrics import mean_squared_error
from sklearn.preprocessing import StandardScaler
```

In [0]:
```
X = (load_boston().data)
Y = (load_boston().target)
Y = Y.reshape(506,1)
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.3)
print(X_train.shape)
print(X_test.shape)
print(Y_train.shape)
print(Y_test.shape)
S = StandardScaler()
X_train = S.fit_transform(X_train)
X_test = S.transform(X_test)
X_train = pd.DataFrame(X_train)
X_test = pd.DataFrame(X_test)
Y_train = pd.DataFrame(Y_train)
```

```
(354, 13)
(152, 13)
(354, 1)
(152, 1)
```

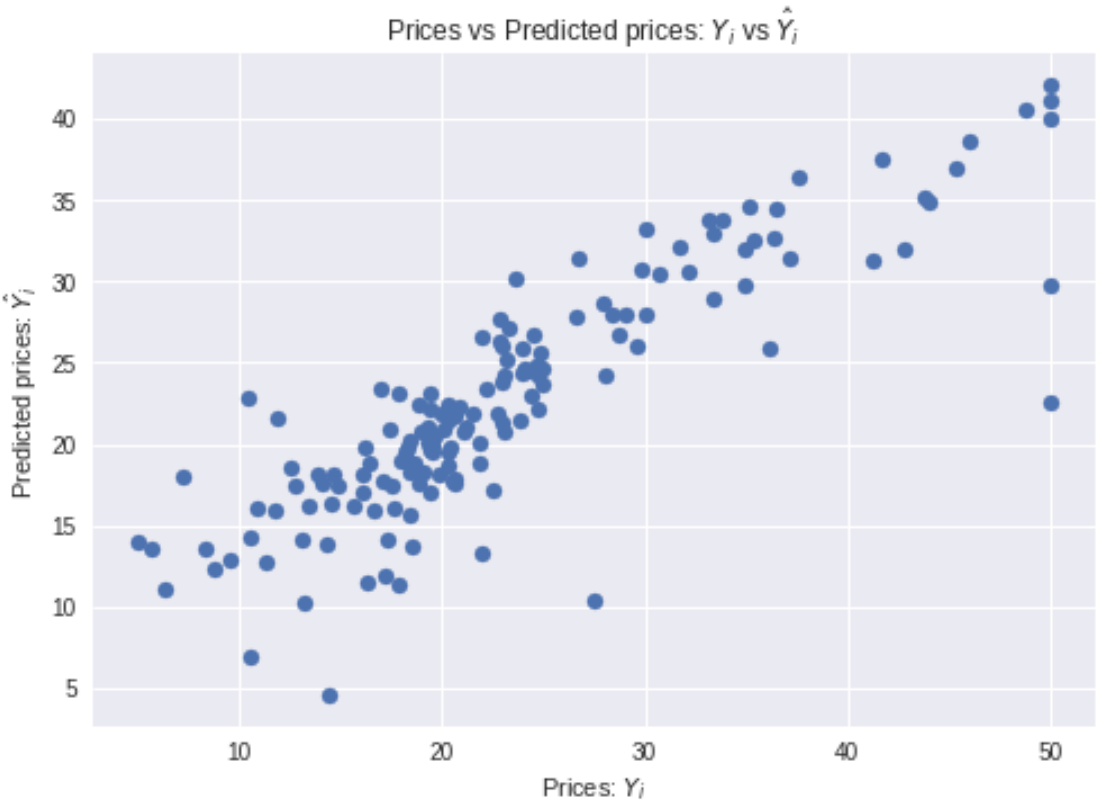
1 Manual SGD Regressor Function

```
In [0]: def manualreg(n_samples,n_iter):
        #Initialise W and b
          W= np.zeros(13)
          W  = np.random.normal(0,1,size = W.size)
          W=W.reshape(13,1)
          b=0
          r=0.1
          t=1


          for i in range(n_iter):

            x = X_train.sample(n=n_samples,random_state=n_iter)
            y=  Y_train.sample(n=n_samples,random_state=n_iter)
            x = x.values
            y=  y.values

            delta = np.dot(x.T,(y - (np.dot(x,W)+b)))
            delta *= -2/x.shape[0]
            delta = r*delta
            W = W - delta
            bias1 = (y- (np.dot(x,W)+b))
            bias1 = np.mean(bias1)
            bias1 *= -2/x.shape[0]
            bias1 = r*bias1
            b = b - bias1


          y_pred = (np.dot(X_test.values,W)+b)
          plt.scatter(Y_test, y_pred)
          plt.xlabel("Prices: $Y_i$")
          plt.ylabel("Predicted prices: $\hat{Y}_i$")
          plt.title("Prices vs Predicted prices: $Y_i$ vs $\hat{Y}_i$")
          plt.show()
          manual = mean_squared_error(Y_test,y_pred)
          print("Mean squared error is {} ".format(manual))
          return W,b,manual
```

2 SKlearn SGD Regressor Implementation

```
In [0]: clf = SGDRegressor()
        clf.fit(X_train.values, Y_train.values)
        a = clf.predict(X_test.values)

        plt.scatter(Y_test, a)
```

```
plt.xlabel("Prices: $Y_i$")
plt.ylabel("Predicted prices: $\hat{Y}_i$")
plt.title("Prices vs Predicted prices: $Y_i$ vs $\hat{Y}_i$")
plt.show()
print("Mean squared error is {} ".format(mean_squared_error(Y_test, a)))
#Getting weights
weightsk = clf.coef_
```

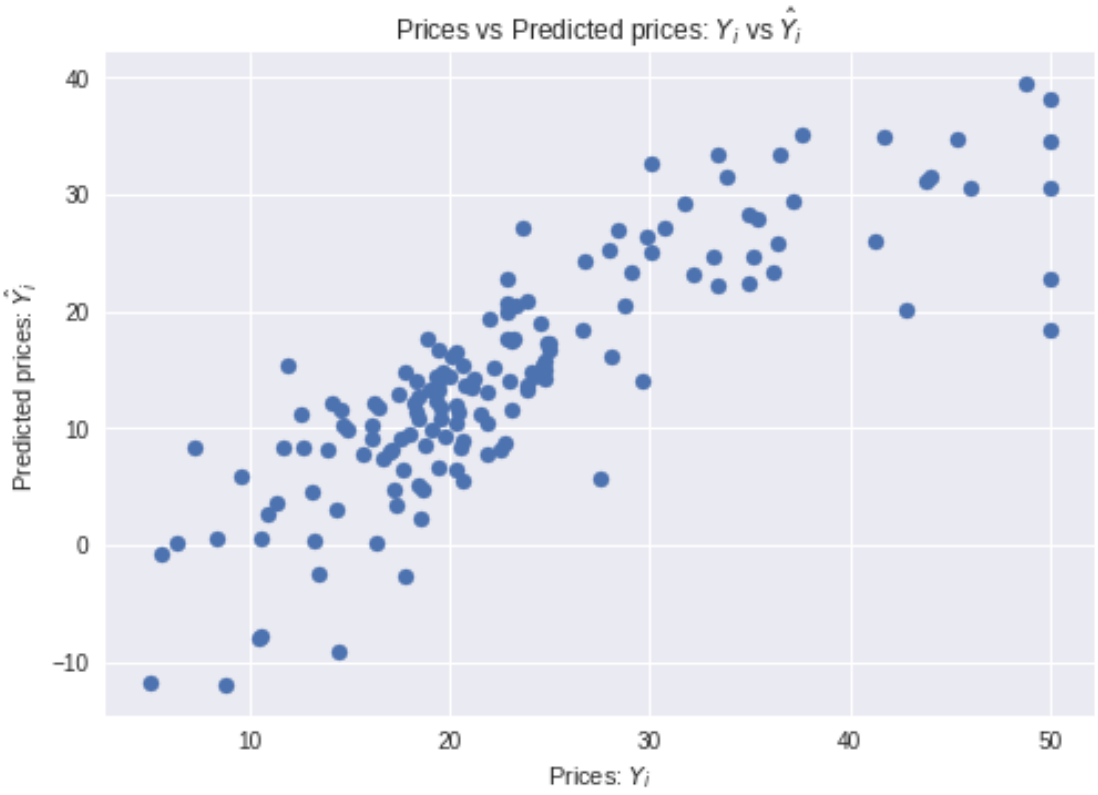



```
Mean squared error is 26.882307061220374
```

3 Implementation of own regressor and comparison.

4 1.1 Taking 100 samples with 500 iterations

```
In [0]: #manual function parameters : manual(no. of samples, no. of iterations.)
        # taking 100,100
        weights,bias,mse = manualreg(100,500)
```

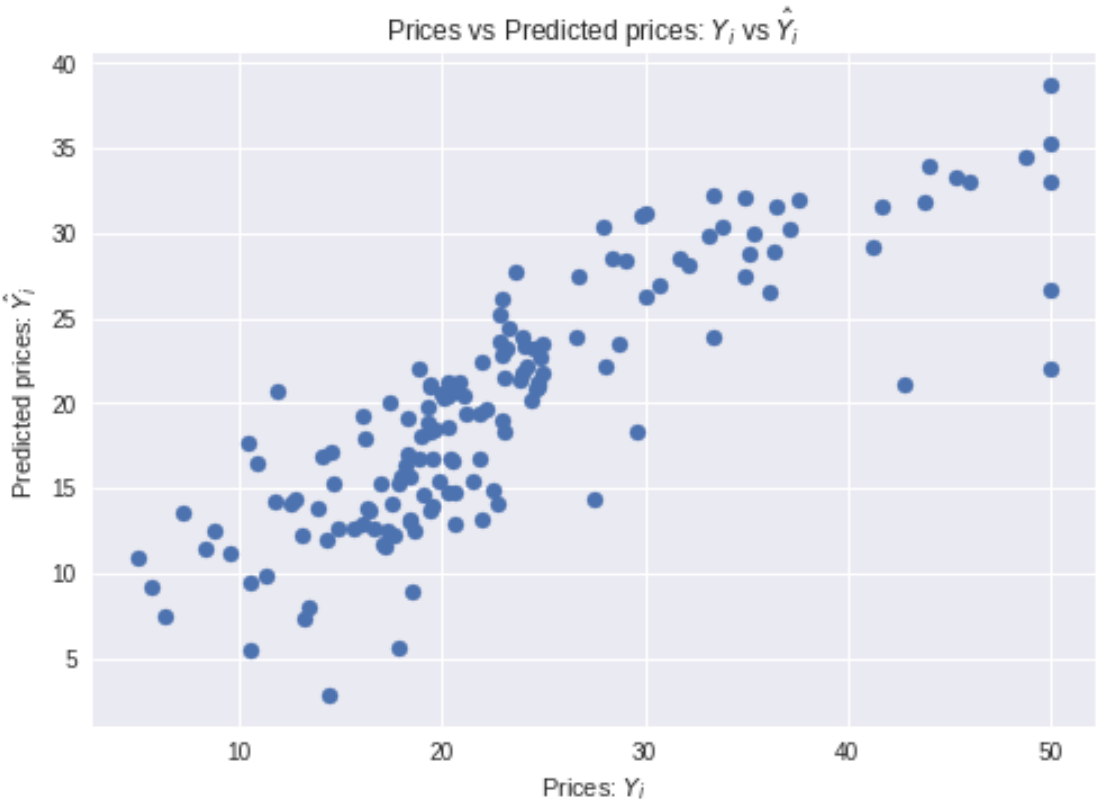



```
Mean squared error is 106.19019289680918
```

The MSE is too large compared to SGDRegressor.

5 1.2 Taking 100 samples with 1000 iterations.

```
In [0]: weights,bias,mse = manualreg(100,1000)
```

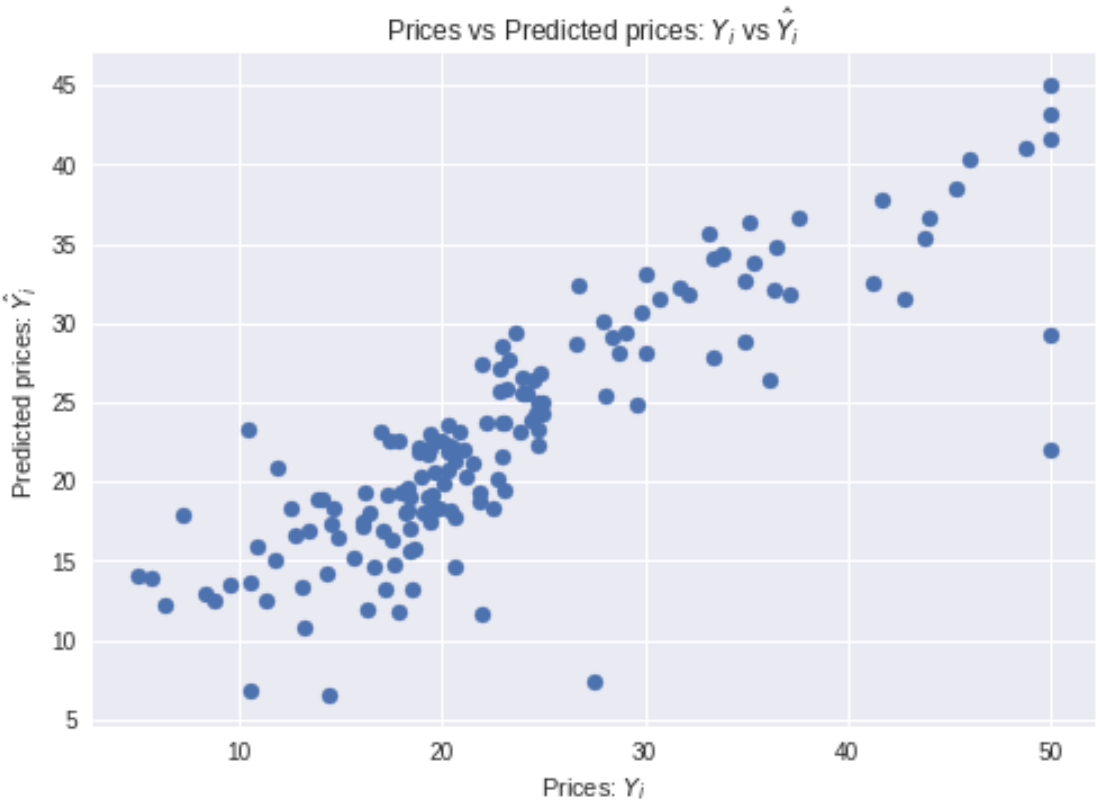



```
Mean squared error is 40.91420139476845
```

Still, the MSE is large.

6 1.3 Increasing the no. of sample to 150 and iterations to 3000

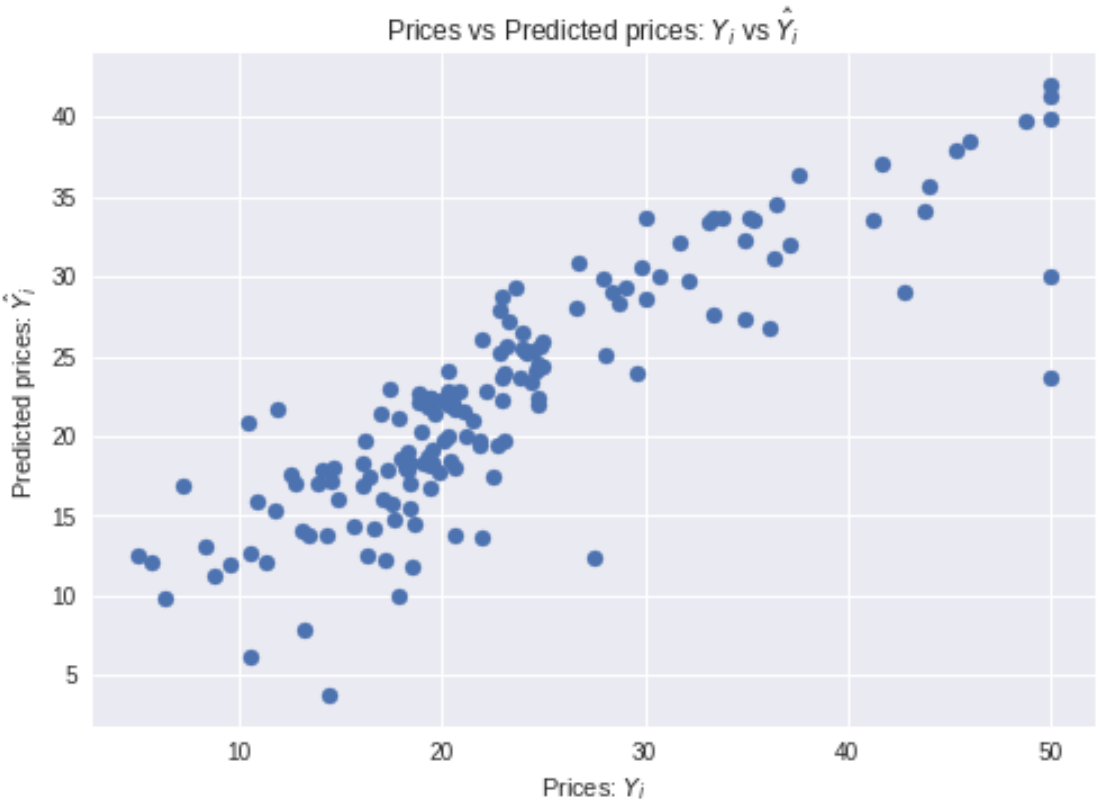
```
In [0]: weights,bias,mse = manualreg(150,3000)
```




```
Mean squared error is 27.288335503046675
```

7 1.3 Taking 200 samples with 3000 iterations.

```
In [0]: weights,bias,mse = manualreg(200,3000)
```

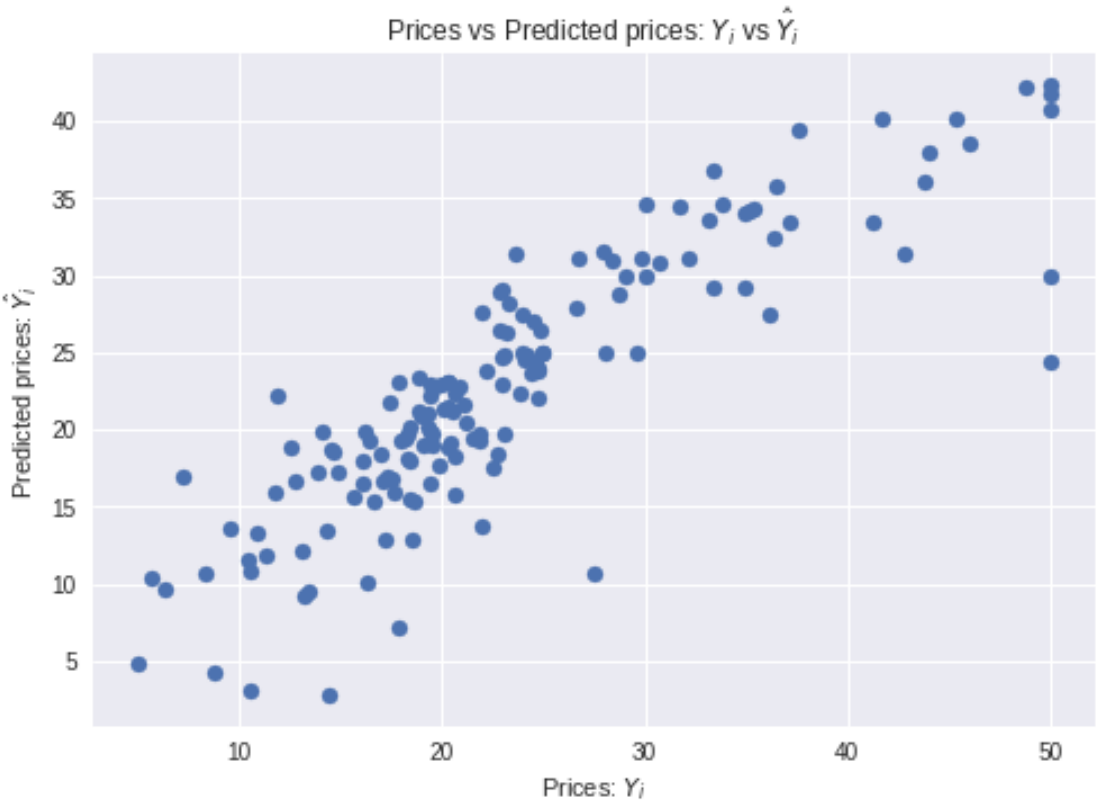



```
Mean squared error is 26.359994348634444
```

Thus, the mse of manual regressor is equal to that of SKlearn's SGD.

8 1.4 Taking 200 samples and 4000 iterations.

```
In [0]: weights,bias,mse = manualreg(200,4000)
```




```
Mean squared error is 24.72414246198188
```

9 Conclusion:

Comparing weights and MSE

```
In [0]: print("Weights of manual regressor vs. weights of SKLEARN SGD REGRESSOR ")
        w = pd.DataFrame(weights,weightsk)
        w
```

```
Weights of manual regressor vs. weights of SKLEARN SGD REGRESSOR
```

```
Out[0]:                   0
         0.019622 -0.943034
         0.427127  1.002010
        -0.556406  0.380954
         0.667442 -0.002882
        -0.838134 -2.371337
         3.133494  3.346550
```

```
-0.188253  0.397533
-1.951816 -3.039427
 0.722935  2.996886
-0.665470 -2.699180
-1.725434 -1.760682
 0.998393  0.581766
-3.198658 -3.836374
```

MSE of Manual Regressor : 24.72414246198188
MSE of SGD Regressor : 26.882307061220374
Conclusion: 1. As iterations increases ,the MSE decreases.

2. From the weights comparison, it can be concluded that the weights are almost similar. Some weights of manual SGD are even a bit less than SGD Regressor since, the MSE also differs by 2.

3. A point comes when , even if the iterations are increased, the MSE doesn't go down beyond a certain point. Thus, samples need to be increased with iterations.

4. The MSE doesn't go below this 24 point. Experimenting furthur, it was observed that, taking additional iterations, the MSE again increased to 25. Observed the same with 300 sample and upto 8000 iterations. The MSE doesn't go below the 24/25 point.