gradient

February 23, 2022

[140]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

[141]:
```
data=pd.read_excel("/Users/abdouniang/Downloads/data.xlsx")
```

[142]:
```
data.shape
```

[142]:
```
(9568, 5)
```

[143]:
```
#Take all features in my dataset
X=data.iloc[:,:-1]
X
```

[143]:

	X1	X2	X3	X4
0	14.96	41.76	1024.07	73.17
1	25.18	62.96	1020.04	59.08
2	5.11	39.40	1012.16	92.14
3	20.86	57.32	1010.24	76.64
4	10.82	37.50	1009.23	96.62
…	…	…	…	…
9563	16.65	49.69	1014.01	91.00
9564	13.19	39.18	1023.67	66.78
9565	31.32	74.33	1012.92	36.48
9566	24.48	69.45	1013.86	62.39
9567	21.60	62.52	1017.23	67.87

[9568 rows x 4 columns]

[144]:
```
#Take the target in mt dataset
y=data.iloc[:,-1]
y
```

[144]:
```
0       463.26
1       444.37
2       488.56
3       446.48
4       473.90
```

```
        ...
9563    460.03
9564    469.62
9565    429.57
9566    435.74
9567    453.28
Name: Y, Length: 9568, dtype: float64
```

[145]:
```
#Dimension of my data set
data.head()
```

[145]:
```
      X1     X2       X3     X4       Y
0  14.96  41.76  1024.07  73.17  463.26
1  25.18  62.96  1020.04  59.08  444.37
2   5.11  39.40  1012.16  92.14  488.56
3  20.86  57.32  1010.24  76.64  446.48
4  10.82  37.50  1009.23  96.62  473.90
```

[146]:
```
#Compute the mean and the std for all column of my dataset
def features_Standart(data):
    mean=np.mean(X,axis=0)
    std=np.std(X,axis=0)
    mse=(data-mean)/std
#     print("mean",mean)
#     print("std",std)
    return mse
```

[148]:
```
#Apply the function to my dataset for all my feature
data.iloc[:,:-1] = features_Standart(data.iloc[:,:-1])
data.head()
```

[148]:
```
         X1        X2        X3        X4       Y
0 -0.629519 -0.987297  1.820488 -0.009519  463.26
1  0.741909  0.681045  1.141863 -0.974621  444.37
2 -1.951297 -1.173018 -0.185078  1.289840  488.56
3  0.162205  0.237203 -0.508393  0.228160  446.48
4 -1.185069 -1.322539 -0.678470  1.596699  473.90
```

[149]:
```
data.describe()
```

[149]:
```
                 X1            X2            X3            X4            Y
count  9.568000e+03  9.568000e+03  9.568000e+03  9.568000e+03  9568.000000
mean   2.757572e-17 -1.742846e-17 -3.563435e-17 -4.355954e-17   454.365009
std    1.000052e+00  1.000052e+00  1.000052e+00  1.000052e+00    17.066995
min   -2.394126e+00 -2.277901e+00 -3.430019e+00 -3.270589e+00   420.260000
25%   -8.240958e-01 -9.888705e-01 -7.003615e-01 -6.836860e-01   439.750000
50%    9.309729e-02 -1.751604e-01 -5.373067e-02  1.141150e-01   451.550000
```

```
75%    8.143721e-01  9.627745e-01  6.737290e-01  7.891378e-01   468.430000
max    2.342804e+00  2.144779e+00  3.374760e+00  1.839173e+00   495.760000
```

[150]:
```
#Split the data for train and test
df=data.iloc[[2,3,4,5,6]]
df.head()
```

[150]:

	X1	X2	X3	X4	Y
2	-1.951297	-1.173018	-0.185078	1.289840	488.56
3	0.162205	0.237203	-0.508393	0.228160	446.48
4	-1.185069	-1.322539	-0.678470	1.596699	473.90
5	0.888177	0.404037	-0.173290	-0.995854	443.67
6	-0.504722	-0.814167	0.128134	0.132266	467.35

[151]:
```
def split_data(df, train_percent):
  ########## fill the code ########
  np.random.seed(1)
  perm=np.random.permutation(df.index)

  n=len(df)

  train_index = int(train_percent * n)

  train = df.iloc[perm[:train_index]]
  test = df.iloc[perm[train_index:]]


  X_train = train.iloc[:,:-1]
  Y_train = train.iloc[:,-1]

  X_test= test.iloc[: , :-1]
  Y_test = test.iloc[:,-1]
  return X_train, X_test, Y_train, Y_test
```

[152]:
```
X_train, X_test, Y_train, Y_test =split_data(data, 0.8)
```

[153]:
```
X_train.shape, X_test.shape
```

[153]:
```
((7654, 4), (1914, 4))
```

[154]:
```
Y_train.shape, Y_test.shape,
```

[154]:
```
((7654,), (1914,))
```

[160]:
```
#Define a function to add One one my features

def Add_ones(X):
    X_new=np.hstack([np.ones((X.shape[0],1)),X])
```

```
    return X_new

#Define a Funcrtion which allow to compute the cost
def Compute_cost(X,y,theta):
    loss=(1/2) *np.sum((X@theta - y)**2)
    return loss
#Define the functionTrain

def Train(X,y,lr,epoch):
    X=Add_ones(X.values)
    m=len(y)
    theta=np.zeros(X.shape[1])
    cost_history=np.zeros(epoch)
#     print("######",X)
    for j in range(epoch):
        cost_history[j]=Compute_cost(X,y,theta)
        theta_new= theta - 1/m * lr * X.T@(X@theta - y)
#         print("theta new")
        theta=theta_new
    return theta,cost_history

#define The function of prediction

def Predict(X,theta):
    X=Add_ones(X.values)
    return X@theta

#Define the MSE(mean Square error)
def Mse(y,yPred):
    Loss=1/len(y) * np.sum((y.values - yPred)**2)
    return Loss
```

[161]:
```
epoch = 30
theta, loss_history = Train(X_train, Y_train, 0.3, epoch)
```

[162]:
```
theta
```

[162]:
```
array([454.33774184, -11.44757209,  -5.43840813,   0.97795748,
       -1.17688825])
```

[163]:
```
loss_history
```

[163]:
```
array([7.91472742e+08, 3.87264176e+08, 1.89772537e+08, 9.30426655e+07,
       4.56475050e+07, 2.24233177e+07, 1.10426031e+07, 5.46516383e+06,
       2.73135663e+06, 1.39097216e+06, 7.33411918e+05, 4.10482178e+05,
       2.51565909e+05, 1.73058164e+05, 1.33989886e+05, 1.14283729e+05,
       1.04099458e+05, 9.86131859e+04, 9.54591972e+04, 9.34764160e+04,
```

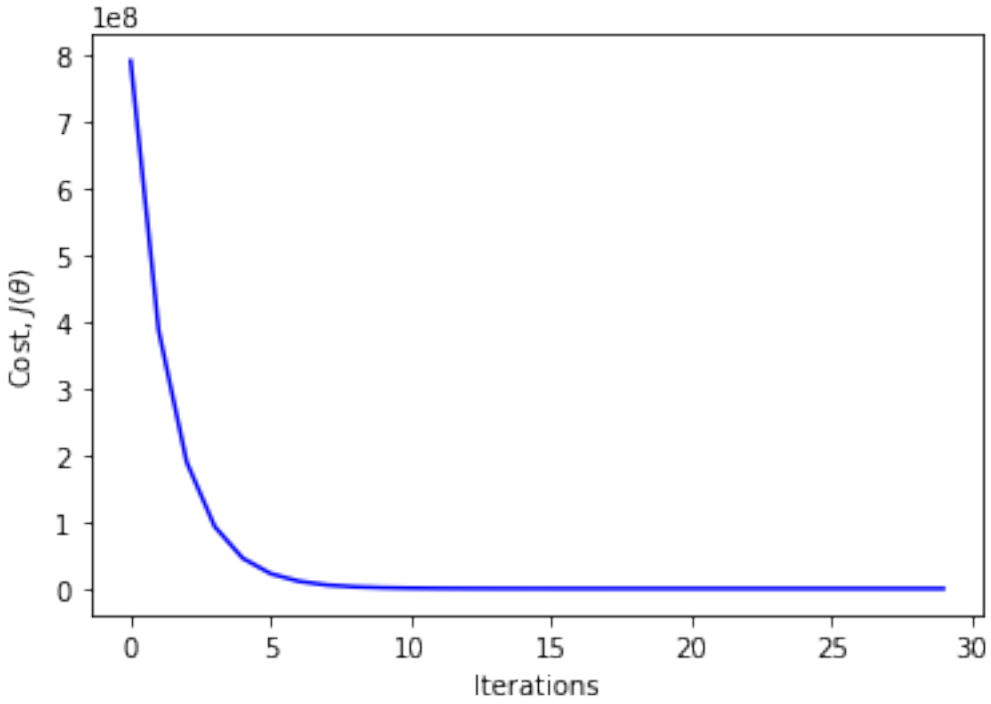
```
9.20941672e+04, 9.10311861e+04, 9.01481230e+04, 8.93752630e+04,
8.86771016e+04, 8.80349801e+04, 8.74385718e+04, 8.68817054e+04,
8.63603136e+04, 8.58714235e+04])
```

[164]:
```
ypred = Predict(X_test, theta)
mse = Mse(Y_test, ypred)
mse
```

[164]: 24.10206904944692

[165]:
```
plt.figure()
plt.plot(np.arange(epoch), loss_history, c='blue')
plt.xlabel('Iterations')
plt.ylabel('Cost, ' + r'$J(\theta)$')
```

[165]: Text(0, 0.5, 'Cost, $J(\\theta)$')



[ ]: