shaikat_303527_exercise10_Q3

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```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        from collections import Counter
        import seaborn as sns
        from sklearn.decomposition import NMF
        import math as Math
```

```
In [2]: data=pd.read_csv(r"E:\Documents\University of Hildesheim\Machine learning lab\lab10\ml-
                         names=["userId","itemId","rating","timestamp"])
        data.head()
```

```
Out[2]:    userId  itemId  rating  timestamp
        0     196     242       3  881250949
        1     186     302       3  891717742
        2      22     377       1  878887116
        3     244      51       2  880606923
        4     166     346       1  886397596
```

```
In [3]: def predict(matrix_,matrix,test):
            yhat=[]
            dval=[]
            for i in range (0,len(test)):
                flag=1
                if(test.iloc[i]['userId'] in matrix_.index):
                    f=matrix_.index.get_loc(test.iloc[i]['userId'])
                else:
                    f=-1
                if(test.iloc[i]['itemId'] in matrix_.columns):
                    t=matrix_.columns.get_loc(test.iloc[i]['itemId'])
                else:
                    t=-1
                if(f==-1 or t==-1):
                    dval.append(i)
                else:

                    yhat.append(matrix[f][t])
            return yhat,test.drop(test.index[dval])
```

```
In [4]: def RMSE(y,yhat):
            rmse =Math.sqrt(np.sum(pow((y-yhat),2))/len(y))
            return rmse
```

```
In [5]: def data_k_divide(data,k):
            k_size=Math.floor(len(data)/k)
            k_data=[]
            c=0
            for i in range (0,k):
                data_set=pd.DataFrame(data.head(0))
                for j in range(i*k_size,(i*k_size)+k_size):
                    data_set=data_set.append(data.iloc[j])
                    c=c+1
                k_data.append(data_set)

            #adding datas which are remaining at the end of k division
            for j in range(c,len(data)):
                k_data[k-1]=k_data[k-1].append(data.iloc[j])
            return k_data

        def k_data_train_test(x,k):
            k_folded_data=[]
            for i in range(0,k):
                x_test=x[i]

                x_train=pd.DataFrame()

                for j in range(0,k):
                    if i!=j:
                        x_train=x_train.append(x[j])

                final_data=dict([('x_train',x_train),('x_test',x_test)])
                k_folded_data.append(final_data)
            return k_folded_data

        def kfold(x_train,k,alpha,lamda):
            rmse=[]
            x_train_k=data_k_divide(x_train,k)
            kdata=k_data_train_test(x_train_k,k)
            for i in range(0,k):
                rMatrix=kdata[i]['x_train'].pivot(index='userId',columns='itemId',values='ratin
                rMatrix=rMatrix.replace(np.nan,0)
                model = NMF(n_components=3, init='random',solver='cd',beta_loss='frobenius',alp
                            max_iter=200,random_state=0)
                W = model.fit_transform(rMatrix)
                H = model.components_
                finalmat=W.dot(H)
                yhat,y=predict(rMatrix,finalmat,kdata[i]['x_test'])
                rmse.append(RMSE(y['rating'],yhat))
            return sum(rmse)/k
```

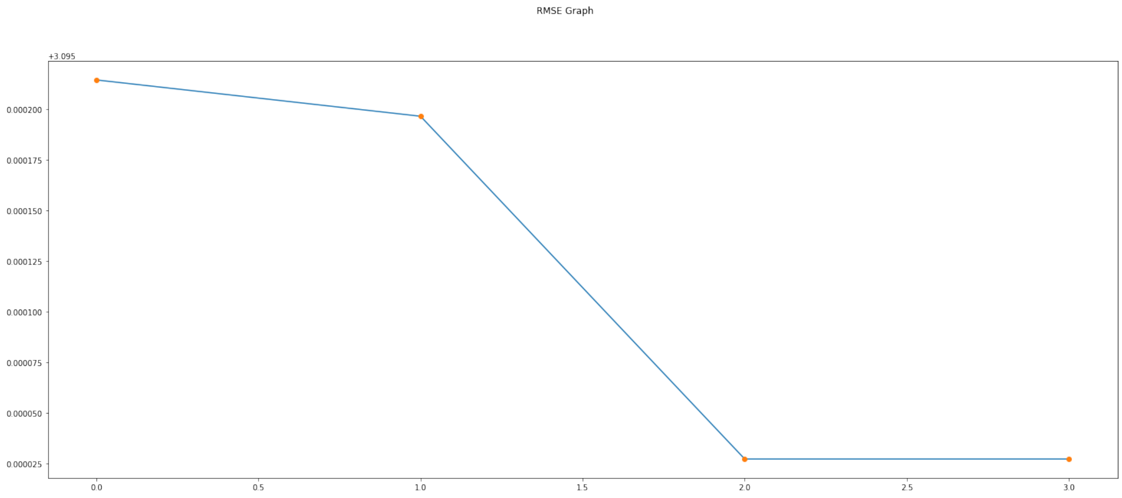
```
In [6]: def gridsearch(alpha,lamda):
            comb=[]
            for i in range(0,len(alpha)):
                for k in range(0,len(lamda)):
                    comb.append(dict([('alpha',alpha[i]),('lamda',lamda[k])]))
            return comb
```

```
In [7]: alpha=[0.1,0.0000001]
        l1=[0.1,0.0001]
        grid=gridsearch(alpha,l1)
        rmsearr=[]
        for i in range (0,len(grid)):
            rmse=kfold(data,3,grid[i]["alpha"],grid[i]["lamda"])
            print("testrmse:" ,rmse,"for k values of :",grid[i])
            rmsearr.append(rmse)
```

```
testrmse: 3.095214233411966 for k values of : {'alpha': 0.1, 'lamda': 0.1}
testrmse: 3.095196327651466 for k values of : {'alpha': 0.1, 'lamda': 0.0001}
testrmse: 3.095027264041237 for k values of : {'alpha': 1e-07, 'lamda': 0.1}
testrmse: 3.095027264023562 for k values of : {'alpha': 1e-07, 'lamda': 0.0001}
```

0.0.1 The rmse score is not better than the before the local bais and global bais is not being considered in the model

```
In [9]: fig,axs=plt.subplots(1,1,figsize=(25,10))
        fig.suptitle("RMSE Graph")
        axs.plot(rmsearr)
        axs.plot(rmsearr,'o')
        plt.show()
```



0.0.2 After Analyzing the graph we can see that the rmse decreased

```
In [ ]:
```