Recommender Systems Report

Siddharth Mal **CAP 5610**

5)**SVD**

```
Evaluating RMSE, MAE of algorithm SVD on 3 split(s).

                  Fold 1  Fold 2  Fold 3  Mean    Std
RMSE (testset)    0.9499  0.9427  0.9446  0.9457  0.0031
MAE (testset)     0.7497  0.7440  0.7453  0.7463  0.0024
Fit time          9.89    8.98    9.17    9.35    0.39
Test time         0.57    0.58    0.53    0.56    0.02

: {'test_rmse': array([0.94989913, 0.94268487, 0.94460542]),
   'test_mae': array([0.74966624, 0.74404881, 0.74528417]),
   'fit_time': (9.893847227096558, 8.983985424041748, 9.165119171142578),
   'test_time': (0.5659093856811523, 0.5811896324157715, 0.5325772762298584)}
```

6)**PMF**

```
Evaluating RMSE, MAE of algorithm SVD on 3 split(s).

                  Fold 1  Fold 2  Fold 3  Mean    Std
RMSE (testset)    0.9657  0.9648  0.9675  0.9660  0.0011
MAE (testset)     0.7608  0.7613  0.7625  0.7616  0.0007
Fit time          8.62    8.21    10.49   9.11    0.99
Test time         0.50    0.49    0.72    0.57    0.11

{'test_rmse': array([0.96573508, 0.96482593, 0.96747769]),
 'test_mae': array([0.76084124, 0.76129585, 0.76251572]),
 'fit_time': (8.62000036239624, 8.209943771362305, 10.488538265228271),
 'test_time': (0.49788594245910645, 0.49398159980773926, 0.7220594882965088)}
```

7) **NMF**

```
Evaluating RMSE, MAE of algorithm NMF on 3 split(s).

                  Fold 1  Fold 2  Fold 3  Mean    Std
RMSE (testset)    0.9778  0.9773  0.9720  0.9757  0.0026
MAE (testset)     0.7689  0.7688  0.7644  0.7674  0.0021
Fit time          9.92    8.63    8.78    9.11    0.58
Test time         0.48    0.48    0.41    0.45    0.03

{'test_rmse': array([0.97781482, 0.97726288, 0.97198659]),
 'test_mae': array([0.76893172, 0.76877083, 0.76436599]),
 'fit_time': (9.922745943069458, 8.63115930557251, 8.782884120941162),
 'test_time': (0.4806191921234131, 0.47755002975463867, 0.40589118003845215)}
```

8)**User Based Collaborative Filtering**

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```
                  Fold 1  Fold 2  Fold 3  Mean    Std
RMSE (testset)    0.9895  0.9859  0.9878  0.9877  0.0014
MAE (testset)     0.7832  0.7797  0.7797  0.7808  0.0016
Fit time          0.75    0.76    0.78    0.76    0.01
Test time         10.40   10.46   10.19   10.35   0.11

{'test_rmse': array([0.98947729, 0.98592916, 0.98777981]),
 'test_mae': array([0.78315787, 0.77966616, 0.779668  ]),
 'fit_time': (0.7476444244384766, 0.7597825527191162, 0.7799127101898193),
 'test_time': (10.3979651927948, 10.45864462852478, 10.191497564315796)}
```

9) Item Based Collaborative Filtering

```
                  Fold 1  Fold 2  Fold 3  Mean    Std
RMSE (testset)    0.9914  0.9806  0.9840  0.9853  0.0045
MAE (testset)     0.7840  0.7763  0.7818  0.7807  0.0032
Fit time          1.08    1.06    1.01    1.05    0.03
Test time         11.30   11.56   11.39   11.42   0.11

{'test_rmse': array([0.9914325 , 0.98062422, 0.98397833]),
 'test_mae': array([0.78395824, 0.77626149, 0.78177725]),
 'fit_time': (1.0849952697753906, 1.0550470352172852, 1.0078012943267822),
 'test_time': (11.297596454620361, 11.56394362449646, 11.39256763458252)}
```

10-12)

```
 Rmse for fold : 1 =
['  SVD  ', '  PMF  ', '  NMF  ', 'User based', 'Item based']
[0.94359996 0.96298722 0.97415664 0.98773502 0.98724828]

 Mae for fold : 1 =
['  SVD  ', '  PMF  ', '  NMF  ', 'User based', 'Item based']
[0.94359996 0.96298722 0.97415664 0.98773502 0.98724828]

 Rmse for fold : 2 =
['  SVD  ', '  PMF  ', '  NMF  ', 'User based', 'Item based']
[0.94476946 0.96648624 0.97637795 0.99151436 0.98308464]

 Mae for fold : 2 =
['  SVD  ', '  PMF  ', '  NMF  ', 'User based', 'Item based']
[0.94476946 0.96648624 0.97637795 0.99151436 0.98308464]

 Rmse for fold : 3 =
['  SVD  ', '  PMF  ', '  NMF  ', 'User based', 'Item based']
[0.94753781 0.97254006 0.97813709 0.99048192 0.98829049]

 Mae for fold : 3 =
['  SVD  ', '  PMF  ', '  NMF  ', 'User based', 'Item based']
[0.94753781 0.97254006 0.97813709 0.99048192 0.98829049]
```

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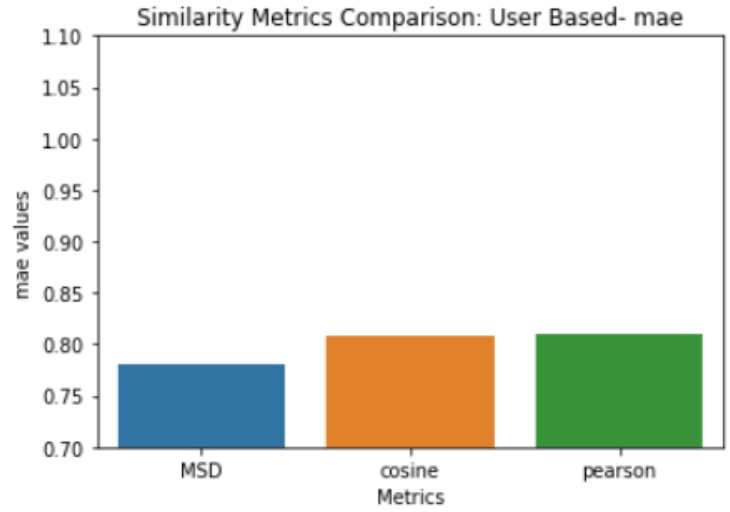
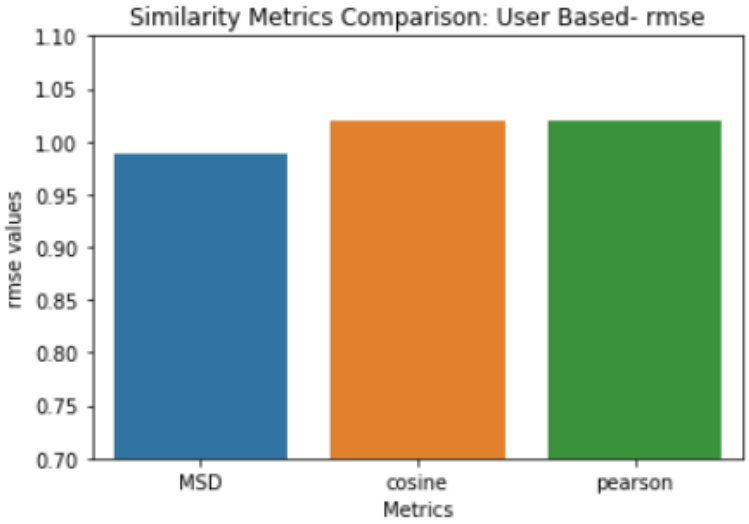
13) Average RSME and MAE for different algorithms

```
              [' SVD ', ' PMF ', ' NMF ', 'User based', 'Item based']
Average RSME is : [0.94530241 0.96733784 0.9762239  0.98991043 0.9862078 ]
Average MAE is  : [0.7456942  0.76241704 0.76607208 0.78237705 0.78070182]
```

14) User based MAE and RMSE wrt MSD Cosine and pearson




```
[0.780631474629455, 0.8077269742201704, 0.8098229145198877]
```




```
[0.9876388594462657, 1.0197429978226313, 1.020362490527477]
```

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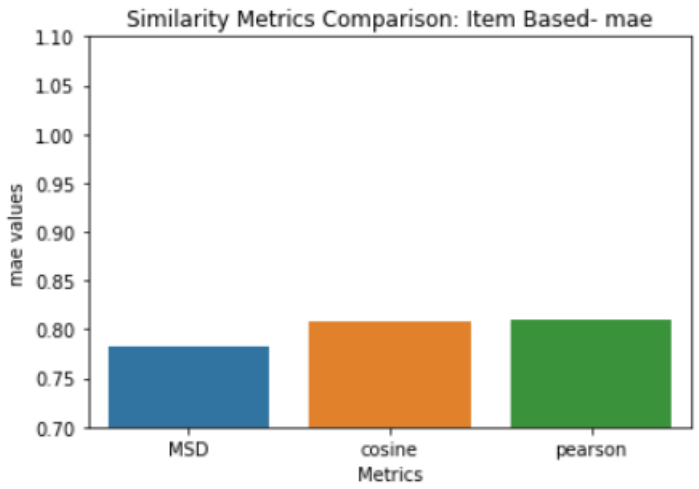
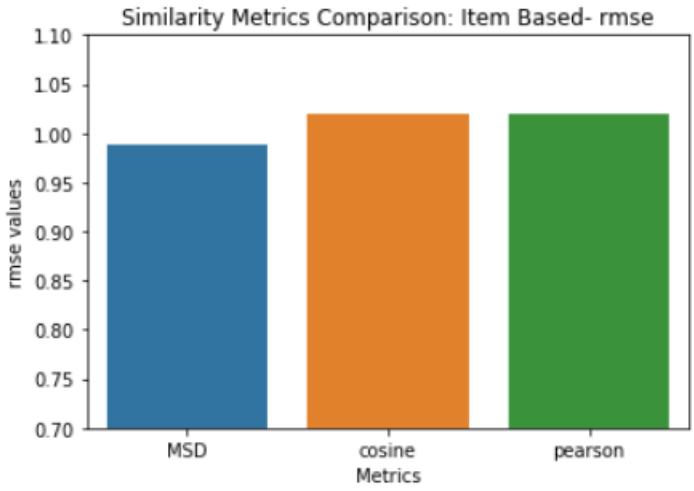
Item based MAE and RMSE wrt MSD Cosine and pearson




```
[0.7816253564438235, 0.8079645194550412, 0.8095608379028657]
```




```
[0.9889441745328998, 1.020269346378727, 1.0195388728066044]
```

The three metrics display the same values w.r.t. RMSE and MAE and the User based trend is almost similar to that of Item based. Furthermore, MSD gives the least RMSE and MAE values as well

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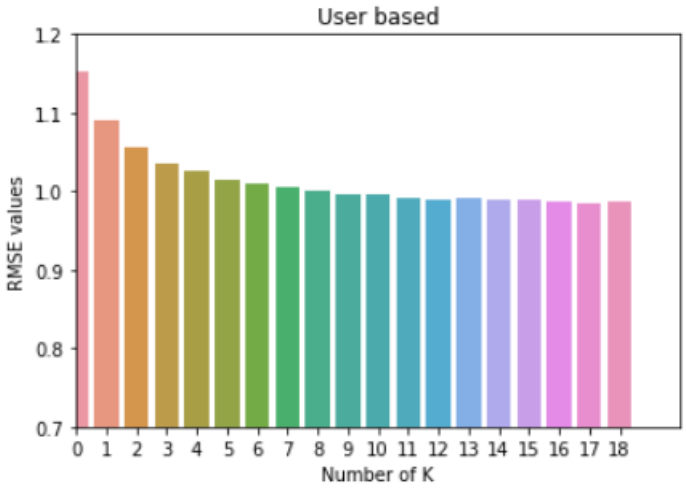
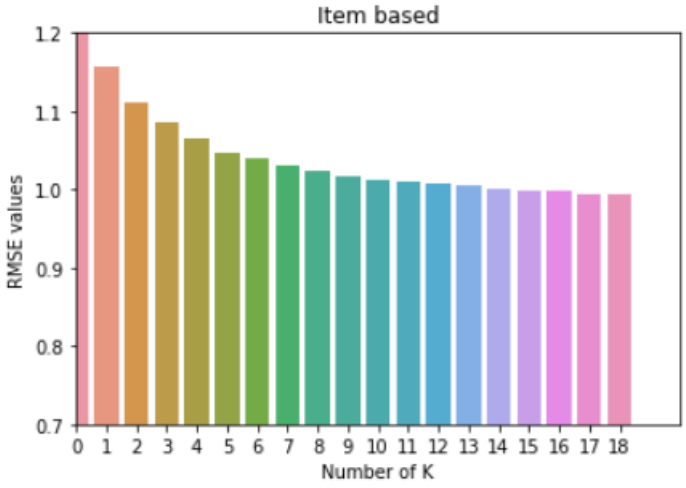
15)

```
Best K=  17
Best RMSE=  0.98542366886906
```




```
Best K=  18
Best RMSE=  0.9932969907656043
```



For K=0 to 20,

Least RSME value for User based is for k=17 and for Item Based is for k=18

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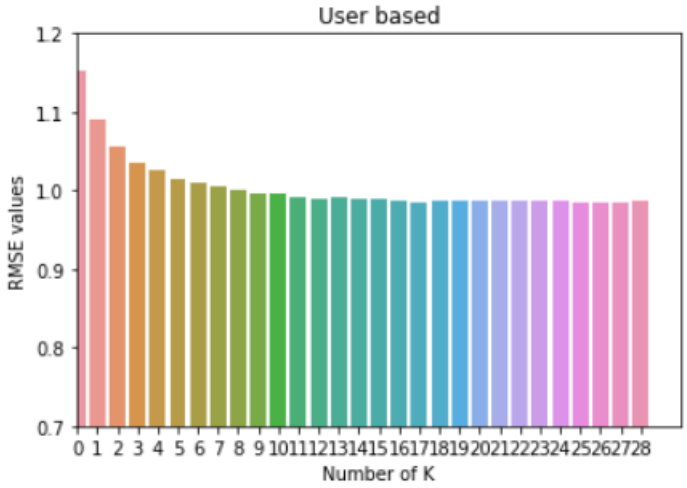
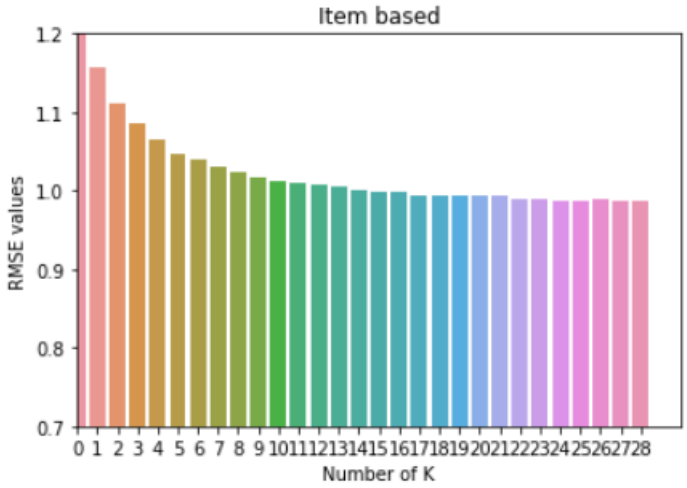
```
Best K=  25
Best RMSE=  0.9852557209329196
```




```
Best K=  28
Best RMSE=  0.9868287532562047
```



For k=0 to 30,

Least RSME value for User Based is for k=25 and fot Item based k=28

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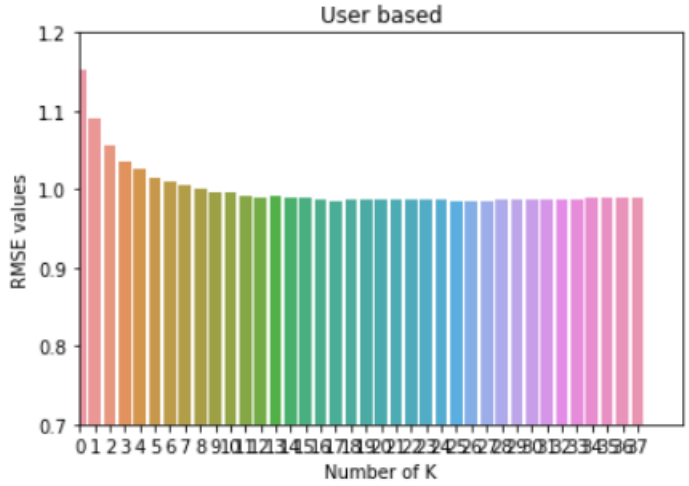
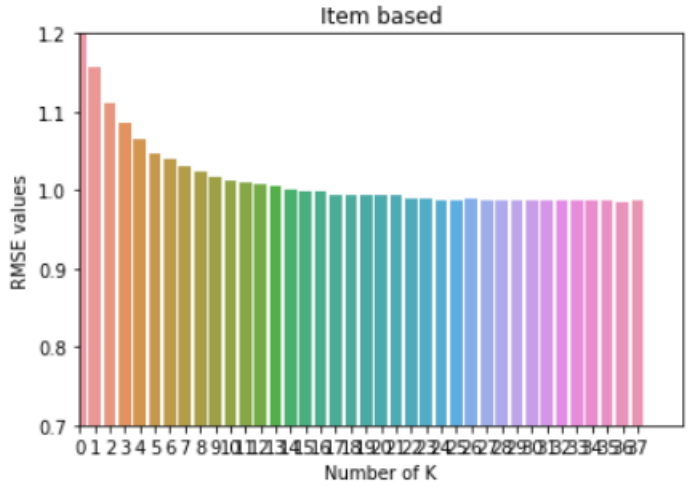
```
Best K=  25
Best RMSE=  0.9852557209329196
```




```
Best K=  36
Best RMSE=  0.9852857069828861
```



For k=0 to 40,

Least RSME value for User Based is for k=25 and fot Item based k=36

The value of k comes out different for User based and item based.

Code Link https://github.com/sidmal11/ml/tree/master/Assign7