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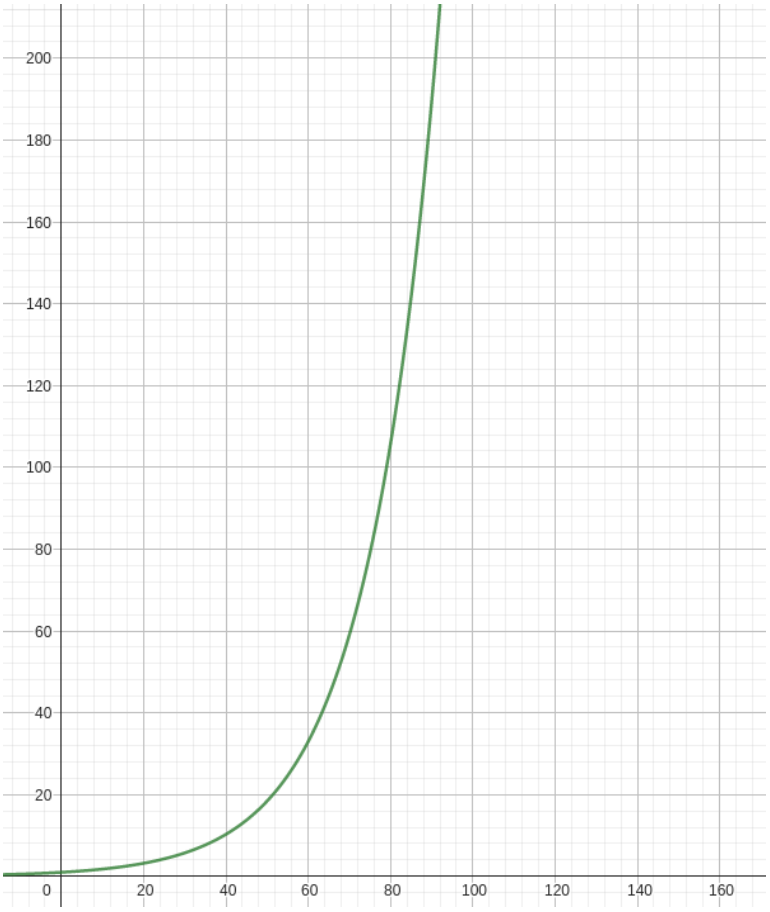
HW5

The best performance of the system for the specific metrics was found to be for k=15 and train=90%. For this k combination we have the highest Precision value with a simultaneously high (compared to the other measurements) Recall value as well as the smallest possible MAE. In general, the deviations between the metrics, for all the options I ran it, (as can be seen below) are very small. We also observe that MAE increases for large values of k as does Recall, while Precision decreases. For the various percentages of the train, we notice that, as the percentage goes up, the metrics also improve.

Regarding the individual details of my implementation:

- I didn't do any filtering on negative similarities.
- The first k similar movies are found. If there are fewer, those that exist are selected.
- All similar movies found have been rated by the user in train.
- The 3rd prediction function (referred to in the images below as “Average User Weighted Function”) uses the weighting function F(x) = 1.06^x for the weights. This particular one was chosen because I noticed that there are usually at most about 120 shared users, so I thought that this function gives small weights for a few users and quite a lot for many in the interval we want:



For constant train = 90%, 5 trials for k (5, 15, 25, 100, 1000):

```
For k = 5 we have the following scores:

Average Function:
MAE: 0.6537399569989815
Precision: 0.8947076752563037
Recall: 0.8847787368132621

Average Weighted Function:
MAE: 0.6514364532134628
Precision: 0.9011004716306988
Recall: 0.8638169612275655

Average User Weighted Function:
Total predictions:
MAE: 0.6570874626129598
Precision: 0.8975080951710545
Recall: 0.8734073160706947

real    0m52,503s
user    0m48,465s
sys     0m1,510s
```

```
For k = 15 we have the following scores:

Average Function:
MAE: 0.643023484416927
Precision: 0.8920815677966102
Recall: 0.9022365072987814

Average Weighted Function:
MAE: 0.6383613738775479
Precision: 0.8952942753720338
Recall: 0.894335074327039

Average User Weighted Function:
Total predictions:
MAE: 0.6408320179366775
Precision: 0.8896750524109015
Recall: 0.9093344047140752

real    0m53,356s
user    0m53,598s
sys     0m1,192s
```

```
For k = 25 we have the following scores:

Average Function:
MAE: 0.6490506267177892
Precision: 0.8834347711034666
Recall: 0.9147828469653377

Average Weighted Function:
MAE: 0.6423223182525666
Precision: 0.8878068303094984
Recall: 0.9117687354432114

Average User Weighted Function:
Total predictions:
MAE: 0.6446668516491009
Precision: 0.8811079174287954
Recall: 0.9239621866009042

real    0m57,686s
user    0m52,816s
sys     0m1,465s
```

```
For k = 100 we have the following scores:

Average Function:
MAE: 0.6782477446745143
Precision: 0.8731814085232393
Recall: 0.9291683792300315

Average Weighted Function:
MAE: 0.6634008220139546
Precision: 0.8761278680072183
Recall: 0.9312234552678449

Average User Weighted Function:
Total predictions:
MAE: 0.6619741030156063
Precision: 0.8694776589049716
Recall: 0.946431017947664

real    1m12,267s
user    1m9,407s
sys     0m1,598s
```

```
For k = 1000 we have the following scores:

Average Function:
MAE: 0.7216848635658272
Precision: 0.8637472710928471
Recall: 0.9214960953555281

Average Weighted Function:
MAE: 0.6889180544142451
Precision: 0.8664631819916062
Recall: 0.9334155363748459

Average User Weighted Function:
Total predictions:
MAE: 0.690304966686529
Precision: 0.863312944701036
Recall: 0.9475270585011646

real    2m20,625s
user    2m18,067s
sys     0m1,572s
```

We notice that the best results are obtained when we take the k=15 most similar movies. Testing for 3 different percentages of the train and with a fixed 10% test set we have:

- For **train = 50%**:

```
For k = 15 we have the following scores:

Average Function:
MAE: 0.6909981568110249
Precision: 0.8814569536423841
Recall: 0.8935284640171858

Average Weighted Function:
MAE: 0.6905641209301521
Precision: 0.8850263763019072
Recall: 0.8784908700322234

Average User Weighted Function:
Total predictions:
MAE: 0.6817210514348059
Precision: 0.8814432989690721
Recall: 0.8954081632653061

real    0m51,413s
user    0m51,567s
sys     0m1,268s
```

- For **train = 70%**:

```
For k = 15 we have the following scores:

Average Function:
MAE: 0.6633992774873922
Precision: 0.886027469624934
Recall: 0.8984866747020223

Average Weighted Function:
MAE: 0.658362239661748
Precision: 0.8902766586086489
Recall: 0.8877728672827105

Average User Weighted Function:
Total predictions:
MAE: 0.6536632817199454
Precision: 0.885605463619648
Recall: 0.9030400428552297

real    0m51,838s
user    0m52,040s
sys     0m1,225s
```

➢ For**train=90%**:

```
For k = 15 we have the following scores:

Average Function:
MAE: 0.643023484416927
Precision: 0.8920815677966102
Recall: 0.9022365072987814

Average Weighted Function:
MAE: 0.6383613738775479
Precision: 0.8952942753720338
Recall: 0.894335074327039

Average User Weighted Function:
Total predictions:
MAE: 0.6408320179366775
Precision: 0.8896750524109015
Recall: 0.9093344047140752

real    0m53,356s
user    0m53,598s
sys     0m1,192s
```