Context Based Recommender

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**Problem**

While driving, quite a few people will listen to music. The songs that they like might depend on external factors along with the song itself. These external factors (dimensions) can be traffic conditions, location, time of day, etc... For example, on a rainy night I might like to listen to a classical song, but on sunny day I like an upbeat, party song. Since external information, the context, has an impact on how much a user likes a song, we want predict how much a user will like a song given that the user is in a certain context. How much they like a song, will be based on a rating system from 0 to 5. Since we have access to so much contextual data, and preferences can change based on this data, this is both a relevant and important problem.

**Method**

Given a user, song/item, and context, the goal is to predict the rating. The predicted rating will be equal to some baseline rating plus a context modifier. The thought behind this is that for a particular song, the user has some baseline preference toward it. For example, if a user absolutely loves a song under most circumstance then they would have a larger baseline. In this project, there were two different baseline conducted.

The first baseline was the average rating the user had given the song across all contexts. If the user had not rated the song, then baseline was the average rating the user had given to all songs across all contexts. The second baseline was found by ignoring the context and reducing the dataset to have at most 1 rating for a user, item pair. Matrix factorization was then performed on this reduced dataset. The baseline would be the rating predicted by the Matrix factorization.

The context modifier is then calculated as follows. Find the average across each context dimension, where for each context dimension given, for all users who rated the item, find the weighted average of the change in rating for that user. All context dimensions had equal weights except the no context given dimension which had ½ of the weight. This means that we assumed that the time of day has the same impact as weather, traffic conditions, etc… The change in rating was found by computing the average rating that user has given that song minus the actual rating that user gave the item in that context dimension. The weight for each user was the user-user similarity in that context.

There are then 4 predicted rating generated from this method, average baseline, model baseline, average baseline + context modifier and model baseline + context modifier.

**Implementation**

The project was implemented in Python and used our own code except a few external libraries. The custom CSR module created for previous programming assignments in the course was utilized and extended for the project. The following external libraries were used

math <https://docs.python.org/2/library/math.html>

numpy <http://www.numpy.org/>

os.path <https://docs.python.org/2/library/os.path.html>

random <https://docs.python.org/2/library/random.html>

collections <https://docs.python.org/2/library/collections.html>

**Dataset**

The data set is a public data and can be found <https://github.com/irecsys/CARSKit/blob/master/context-aware_data_sets/Music_InCarMusic.zip>

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| --- | --- |
| Number of Users | 42 |
| Number of Items | 139 |
| Number of Ratings | 4012 |
| Total number of Contexts | 26 |
| Number of Dimensions | 8 |

Originally the dataset consisted of some irrelevant information such as song name/artists that were all removed. The only data we kept was the rating information as well as a key. Since the data originally had string values like “sunny”, the key was used to translate them into integer values. The user id numbers, and song id number numbers were also change to start from 1 and increment rather than starting in the 1000s (users) or sporadic numbering (items).

**Protocol**

**Results**

**Conclusion**

**Contributions**