PDS – Assignment 3

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Slope One Scheme

- dev_j,i – deviation between two movies, Frozen and Transformers.
- sum_of_ratings_S_j,i(x) – adding quantities of ratings for both Frozen and Transformers movies.
- u_j – u_i – for each child, we are calculating the difference between the rating of Frozen (u_j) and Transformers (u_i).
- card(S_j,i(x)) – total number of children who have rated both Frozen and Transformers.
- (u_j – u_i)/card(S_j,i(x)) – dividing the user rating deviation by the cardinality.

$$\text{dev}_{j,i} = \sum_{u \in S_{j,i}(\chi)} \frac{u_j - u_i}{card(S_{j,i}(\chi))}.$$

The Weighted Slope One Equation

- dev_j,i – deviation between two movies, Frozen and Transformers.
- λ – number between 0 and 1.
- S_j,i(x) – set of evaluations consisting of Frozen and Transformers.
- Uj – Ui – difference in ratings for Frozen and Transformers.
- card(S_j,i(x)) – total number of people who have rated Frozen and Transformers.
- exp(sim(u,u')) – exponential similarity between a user, u and user, u' (Bobby).

$$dev_{j,i} = \lambda \sum_{u \in S_{j,i}(\chi)} \frac{u_j - u_i}{card(S_{j,i}(\chi))} + (1 - \lambda)\frac{\sum_{u \in S_{j,i}(\chi)} ((u_j - u_i) \cdot exp(sim(u, u')))}{\sum_{u \in S_{j,i}(\chi)} (exp(sim(u, u')) \cdot card(S_{j,i}(\chi)))},$$

$$(1)$$

Personalized Weighted Slope Equation

- P^(pwSl)[u']_j – predicted rating Bobby will give Frozen.
- S(u') – {j} – set of movies rated by Bobby that exclude Frozen.
- dev_{j,i} + u'_i – the usual deviation between ratings for Frozen and ratings for Transformers added to the rating Bobby gave for Transformers.
- c_{j,i} – number of children who have rated both Frozen and Transformers.

$$P^{pwSl}(u')_j = \frac{\sum_{i \in S(u') - \{j\}}((dev_{j,i} + u'_i)c_{j,i})}{\sum_{i \in S(u') - \{j\}} c_{j,i}},$$

How does Lambda affect the Personalized Weighted Slope

- The Weighted Slope equation helps us quantify how much people who rated both Frozen (j) and Transformers (i) prefer one over the other.
- The Weighted Slope is calculated two ways and then combined with λ.
- The first part simply calculates the average difference in ratings between Frozen and Transformers.
- The second part ($1-\lambda$) calculates a weighted average difference in ratings, where more weight is given to the ratings of users who are more similar to Bobby.
- All of the above comes into the computation of the weighted personalized slope equation as shown here.

$$dev_{j,i} = \lambda \sum_{u \in S_{j,i}(\chi)} \frac{u_j - u_i}{card(S_{j,i}(\chi))} + (1 - \lambda) \frac{\sum_{u \in S_{j,i}(\chi)} ((u_j - u_i) \cdot exp(sim(u, u')))}{\sum_{u \in S_{j,i}(\chi)} (exp(sim(u, u')) \cdot card(S_{j,i}(\chi)))},$$

$$(1)$$

$$P^{pwSl}(u')_j = \frac{\sum_{i \in S(u') - \{j\}} ((dev_{j,i} + u'_i)c_{j,i})}{\sum_{i \in S(u') - \{j\}} c_{j,i}},$$

In conclusion

In conclusion, λ helps us balance the importance of the general preference for Frozen over Transformers among all users who rated both movies versus the preference among users who are more similar to Bobby. This gives us the flexibility to adapt the recommendation model to different contexts or assumptions about what kind of information is most useful for predicting Bobby's ratings.