Implicit vs. Explicit Trust in Social Matrix Factorization

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Implicit vs. Explicit trust in Social Matrix Factorization

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Motivation
- Incorporating social trust in Matrix Factorization (MF) proved to improve rating prediction accuracy
- Such approaches assume that users themselves explicitly express the trust scores.
- It is often very challenging to have users giving trust scores of each other but implicit trust scores may be predicted based on the users’ interaction histories.
- Problem: how to compute and predict trust between users more accurately and effectively.

Contribution
1. We evaluate several well-known Trust Metrics (TM) to find out which one is closest to the real, explicit scores, and therefore, can make the most accurate trust prediction.
2. We try to incorporate the candidate TMs in social MF to answer this research question: Can we incorporate implicit trust into social matrix factorization when explicit trust relations are not available?

Empirical study
Dataset: Epinions
Number of user: 49,290
Number of items: 139,738
Issued trust statements: 487,181

Comparing the inferred trust scores (implicit) with the ground trust scores (explicit)

<table>
<thead>
<tr>
<th>Trust metric</th>
<th>DCG@10</th>
<th>aDCG</th>
<th>P@10</th>
<th>R@10</th>
<th>MRR</th>
<th>Cvg</th>
</tr>
</thead>
<tbody>
<tr>
<td>O'Donovan &amp; Smyth [9] (TM1)</td>
<td>0.007</td>
<td>0.007</td>
<td>0.001</td>
<td>0.022</td>
<td>98.8%</td>
<td></td>
</tr>
<tr>
<td>Latini et al. [7] (TM2)</td>
<td>0.004</td>
<td>0.004</td>
<td>0.001</td>
<td>0.014</td>
<td>99.7%</td>
<td></td>
</tr>
<tr>
<td>Hwang &amp; Chen [4] (TM3)</td>
<td>0.006</td>
<td>0.005</td>
<td>0.001</td>
<td>0.020</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Shambour &amp; Lu [12] (TM4)</td>
<td>0.006</td>
<td>0.005</td>
<td>0.001</td>
<td>0.017</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Papgegis et al. [10] (TM5)</td>
<td>0.028</td>
<td>0.007</td>
<td>0.003</td>
<td>0.071</td>
<td>9.5%</td>
<td></td>
</tr>
</tbody>
</table>

Performance comparison of the SocialMF using implicit trust against the baselines (the lower, the better); lowest values for each k in bold face and best values underlined.

- PMF: 1.1741, 1.1705, 0.9471, 0.9507
- SocialMF-explicit trust: 1.0976, 1.0934, 0.9161, 0.9154
- SocialMF-TM1: O’Donovan & Smyth [9]: 1.0926, 1.1003, 0.9145, 0.9170
- SocialMF-TM2: Latini et al. [7]: 1.0688, 1.1005, 0.9160, 0.9175
- SocialMF-TM3: Hwang & Chen [4]: 1.0947, 1.1006, 0.9154, 0.9174
- SocialMF-TM4: Shambour & Lu [12]: 1.0970, 1.0990, 0.9153, 0.9167
- SocialMF-TM5: Papgegis et al. [10]: 1.0972, 1.1006, 0.9150, 0.9186

Discussion
- The metric defined by O’Donovan and Smyth performs best although there is a trade-off between accuracy and coverage.
- The SocialMF on implicit trust inferred by O’Donovan and Smyth’s (TM1) can perform as accurate as the SocialMF with explicit trust.
- The implicit trust can be incorporated into the social matrix factorization whenever explicit trust is not available.
- The results of prediction accuracy (MAE and RMSE) conform to the results of comparing the trust metrics where O’Donovan and Smyth’s (TM1) was selected as the best candidate for inferring trust scores.

Proposed approach

Conclusions
The social MF with implicit trust outperforms one of the baselines (PMF) and performs in ways similar to the SocialMF using explicit trust.

A clear advantage of this result is that, since we often have no trust scores explicitly given by users in social networks, we can overcome this problem by using implicit (or inferred) trust scores and incorporate them into the recommender.

Future Work
In the future, we aim to define and infer trust scores taking into account context data of users rather than their ratings only.

We also want to evaluate additional dimensions of recommendation quality, such as diversity, novelty or serendipity.

References