Confidence-aware Matrix Factorization for Recommender Systems

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Introduction

Motivation: Existing accuracy-oriented MF methods cannot always meet the expectation of end-users. Users do not necessarily prefer the items with higher predicted ratings.

Fact: In practice, a user often has several alternatives in the recommendation. Confidence weighs in the user’s decision significantly when the rating itself is not sufficient to make conclusive decisions.

Definition: The confidence of rating prediction is defined as the recommender system's trust in its prediction.

How to build confidence-aware recommender systems?

Goal: Optimize accuracy of rating prediction and measure the prediction confidence simultaneously in a general framework.

Challenges:
- Requires an unified way to understand and measure the ratings and confidence from an overall perspective.
- Influence of users and items on rating variances should be both considered.
- The confidence of ratings should be employed to improve the accuracy of rating prediction.

Implementation

We propose two implementations, i.e., Confidence-aware Probabilistic Matrix Factorization and Confidence-aware Bayesian Probabilistic Matrix Factorization, with gradient descent and Bayesian inference, respectively.

Experiments

Table 1: The statistics of the datasets

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Users</th>
<th>Items</th>
<th>Ratings</th>
<th>sparsity</th>
</tr>
</thead>
<tbody>
<tr>
<td>MovieLens</td>
<td>60,408</td>
<td>3,352</td>
<td>100M</td>
<td>4.19%</td>
</tr>
<tr>
<td>Netflix Jester</td>
<td>480,197</td>
<td>17,770</td>
<td>100M</td>
<td>1.89%</td>
</tr>
<tr>
<td>Netflix</td>
<td>480,197</td>
<td>17,770</td>
<td>100M</td>
<td>21.28%</td>
</tr>
</tbody>
</table>

2. Accuracy Evaluation

3. Confidence Measurement Evaluation

4. Top-K Recommendations Evaluation

5. Analyzing the Variance Parameters on MovieLens

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