Recommender System (RS)
- Discover items of interest from a large resource collection
- Basic recommendation method: Collaborative Filtering (e.g., matrix factorization)
- Suffer from cold-start problem
- Integrate more rich information (e.g., social network)

Heterogeneous Information Network (HIN)
- Include multiple types of nodes and links
- Model heterogeneous data and contain rich semantics
- Meta-path: Semantic paths between two objects in HIN

**Background**

**Traditional HIN based Recommendation**
- Path based relatedness as direct features
- Path based similarities for enhancing user/item representations

**Drawbacks**
- Representations aren’t tailored for recommendation
- Without explicit representation for path/meta-path
- Only capture two way user-item interactions

**Our idea**
- Learn explicit representations for meta-path based context tailored for the recommendation task
- Model a three-way interaction: (user, meta-path, item)

**MCRec : The Proposed Model**

**Challenges**
- Heterogeneity
- Interpretability
- Mutual Effect
- Rank

**Solutions**
- A flexible deep NN based framework
- Meta-path based context embedding
- A neural co-attention model
- A ranking predication model

**Benefits**
- Comprehensively and flexibly utilize heterogeneous information
- Utilize context semantics for interpretable recommendation
- Utilize the mutual effect between user-item pair and meta-path based context
- A more useful ranking model for HIN based recommendation

**Datasets**

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Relation (key)</th>
<th>src</th>
<th>dst</th>
<th>hop</th>
<th>Metapath</th>
</tr>
</thead>
<tbody>
<tr>
<td>MovieLens</td>
<td>User-Movie</td>
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<td>3068</td>
<td>1062</td>
<td>TMFM</td>
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<td>3286</td>
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<td>3286</td>
<td>3068</td>
<td>1062</td>
<td>MF</td>
</tr>
</tbody>
</table>

**Effectiveness Experiments**

**Model**
- MetaRec

**Evaluation Metric**
- Prec@10, Recall@10, NDCG@10

**Comparing Methods**
- ItemKN
- BPR
- MF
- NeaMF
- SVDFeature
- MCRec

**Performance**

**Cold-start Recommendation**
- Warmstart
- TMFM

**Impact of Different Meta-paths**
- MF
- MCRec

**Conclusions**
- We designed a three-way neural interaction model by explicitly incorporating meta-path based context
- The co-attention model mutually improved the representations
- Extensive experimental results show the effectiveness of MCRec
- More materials in webpage: www.shichuan.org

**Acknowledgements**
- This work is supported in part by the National Natural Science Foundation of China (No. 61772082, 61502502, 6132010006, 61373508), the National Key Research and Development Program of China (2017YFB0803004), and the Beijing Municipal Natural Science Foundation (4182043, 4162032). This work is also supported in part by NSF through grants IIS-1526499, IIS-1763235, and CNS-1626432, and NSFC 61672313.

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