Temporal Collaborative Filtering with Graph Convolutional Neural Networks

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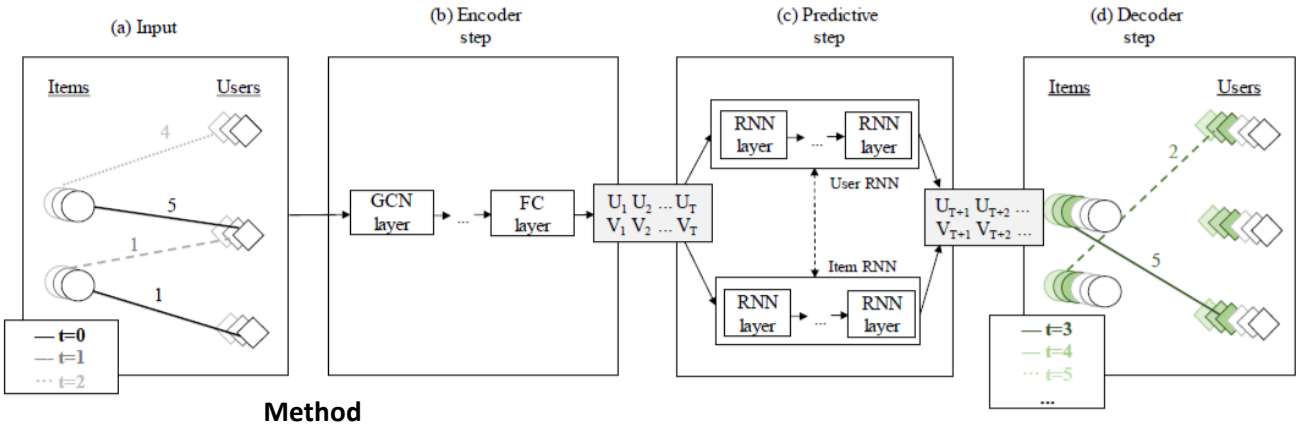
Introduction

- **Temporal collaborative filtering (TCF)** methods model non-static aspects behind recommender systems such as the dynamics in users' preferences and social trends around items.
- State-of-the-art TCF methods employ matrix-factorization-based (MF-based) approaches to learn users' and items' representations and recurrent neural networks (RNNs) to model such aspects.
- Recently, **graph-neural-network-based** (GNN-based) approaches have shown improved performance in providing accurate recommendations over traditional MF-based approaches in non-temporal CF settings.



Method

- We propose a novel TCF method that leverages **user-item interactions** to efficiently predict future ratings.
- We employ GNNs to learn user and item representations, and RNNs to model their **temporal dynamics**.
- A challenge with this method lies in the increased **data sparsity**, negatively impacting the quality of representations obtained with GNNs.
- To overcome this, we train a GNN model at each time step using the set of observed interactions accumulated time-wise.

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Results

- We perform comprehensive experiments on the **Netflix and MovieLens 1M** (ML-1M) datasets.
- We show improved performance of our method over several state-of-the-art MF-based, graph-based, non-temporal and temporal CF models with respect to RMSE and MAE.

Method	Netflix	ML-1M
PMF	0.957	0.883
I-AutoRec	0.979	**0.833**
U-AutoRec	0.985	0.877
GCMC	1.264	1.001
TG-MC (ours)	**0.931**	0.834

Method	RMSE (Netflix)
Temporal MF	1.112
RRN	0.944
TimeSVD++	0.962
NCF	0.947
LFM	0.936
TG-MC (ours)	**0.931**

Method	MAE (ML-1M)
Temporal MF	0.843
RRN	0.793
AM^N=1	0.777
NTF	0.689
TG-MC (ours)	**0.664**

References

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