7 Supplementary

7.1 Frequency distribution of users and items in co-occurrence contexts
To better understand the item irregularity on Delicious, we plot the frequency distribution of users and items in co-occurrence contexts with respect to their degrees, on the four datasets in Fig. 4.
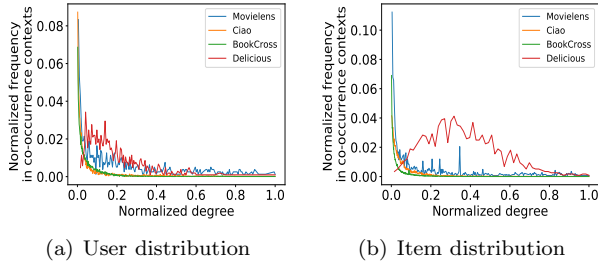

(a) User distribution   (b) Item distribution

Figure 4: Distribution of users and items in co-occurrence contexts. We normalize the degree and frequency between [0, 1] for better visualization.

7.2 Parameter Sensitivity
In addition, we examine the impact of the embedding size d and the regularization parameter λ. For brevity we only present the results on the Movielens datasets using HR@20 as the metric. Similar findings have been observed on other datasets and metrics. First, we vary the embedding size $d \in \{16, 32, 64, 128\}$ in Fig 5(a), where the performance is stable at around 64 or 128. A very small d may lack the expressiveness to model complex interactions. Second, we vary the regularization parameter $\lambda \in \{0.001, 0.005, 0.01, 0.05, 0.1\}$ in Fig. 5(b), where the performance is largely stable between 0.005 and 0.05.
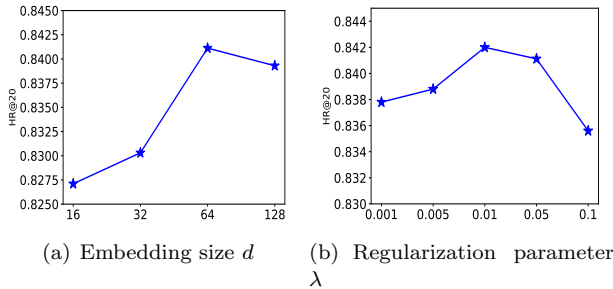

(a) Embedding size d (b) Regularization parameter λ

Figure 5: Parameter study for MMCF on Movielens.

7.3 Attention Visualization
Finally, to visualize how the multiplex memory layer with the multi-hop design works, we present a case study on user $u344$ and item $i1082$ in the Movielens dataset. The attentive weights learned in the IM and item CCM are shown as heatmaps in Fig. 6. As the number of hops increases, the IM attention becomes more concentrated in fewer memory slots in Fig. 6(a). Meanwhile, each cell in Fig. 6(b) represents the mean attention weights of the movies in a genre in the co-occurrence contexts of movie $i1082$, and we showcase the ten most relevant genres. We observe that the genre "drama" attains the highest weight after 3 hops of the item CCM, which is intuitive since movie $i1082$ also belongs to the same genre, demonstrating that the CCM can capture the most relevant context.
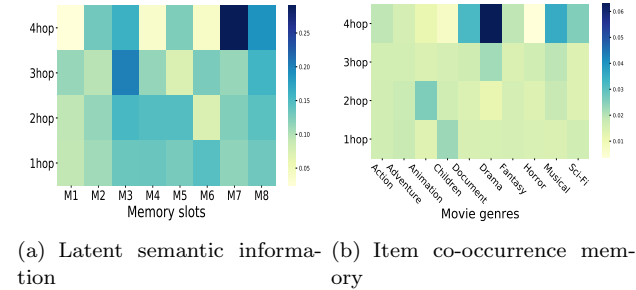

(a) Latent semantic information   (b) Item co-occurrence memory

Figure 6: Attention visualization on Movielens.