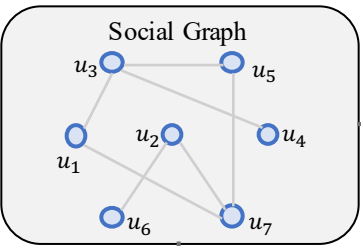
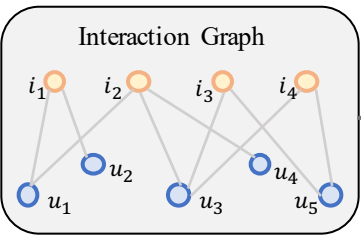


Item User

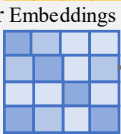
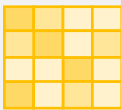


Backbone Recommendation Model

Graph Convolutional Encoder

$$\mathbf{e}_{u_i}^{(k+1)} = \sum_{j \in \mathcal{N}_{u_i}} \frac{1}{\sqrt{|\mathcal{N}_{u_i}|} \sqrt{|\mathcal{N}_{v_j}|}} \mathbf{e}_{v_j}^{(k)}$$
$$\mathbf{e}_{v_i}^{(k+1)} = \sum_{j \in \mathcal{N}_{v_i}} \frac{1}{\sqrt{|\mathcal{N}_{v_i}|} \sqrt{|\mathcal{N}_{u_j}|}} \mathbf{e}_{u_j}^{(k)}$$

User Embeddings



\mathcal{L}_{rec}

Personalized PageRank

$$\mathbf{Q} = a \cdot (\mathbf{I} - (1 - a) \cdot \bar{\mathbf{S}})^{-1}$$

Dot Production

$$\hat{\mathbf{P}}_{i,j} = \mathbf{e}_{u_i} \cdot \mathbf{e}_{u_j}$$

\mathcal{L}_{sh}

Social Intimacy Learning Component

Dual Contrastive Learning Component

Sub-graph CL

Contrastive Learning

Sub-graph Encoder

Sub-graph Extraction

PPR-based CL

Contrastive Learning

Personalized Embedding Propagation

User Embeddings

\mathcal{L}_{cl}^l

\mathcal{L}_{cl}^g