

Leave No One Behind: Fairness-Aware Cross-Domain Recommender Systems for Non-Overlapping Users

Weixin Chen^{* 1}, Yuhan Zhao^{* 1}, Li Chen¹, Weike Pan²



¹ Hong Kong Baptist University

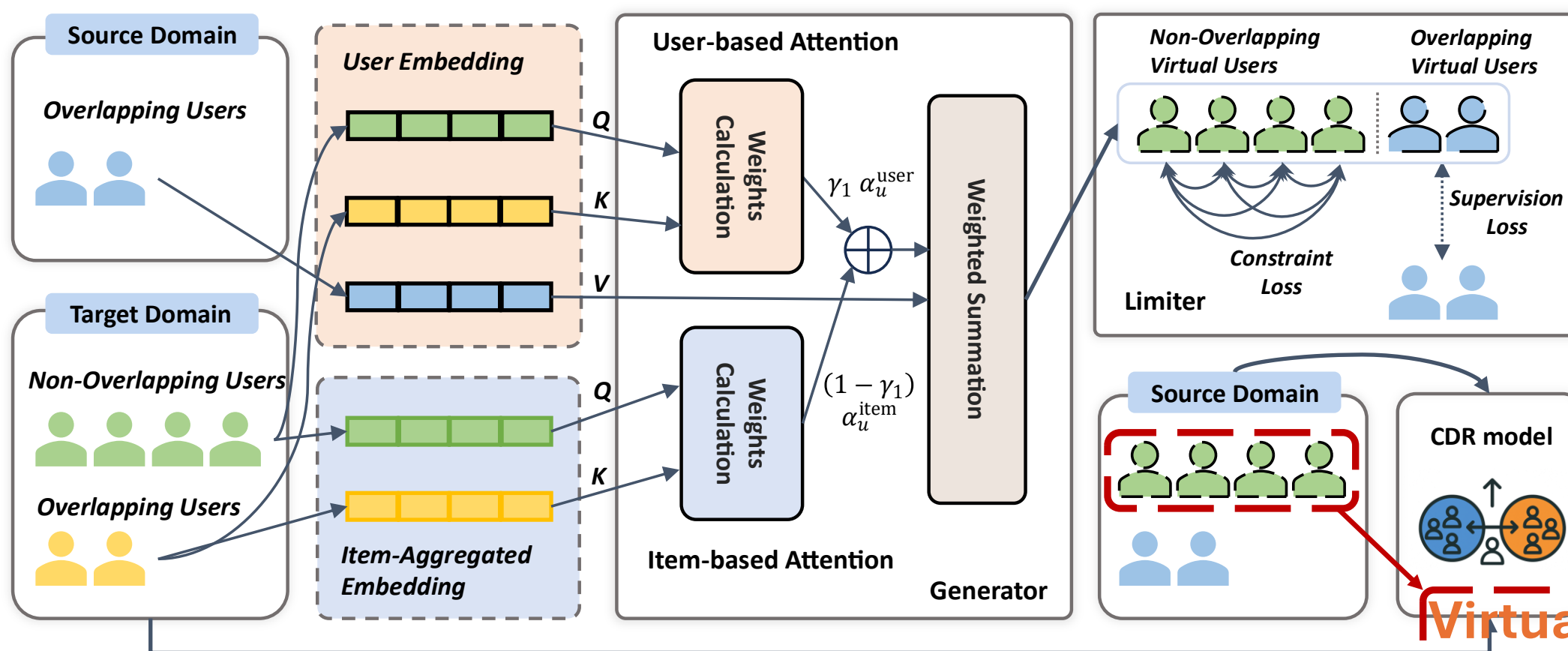
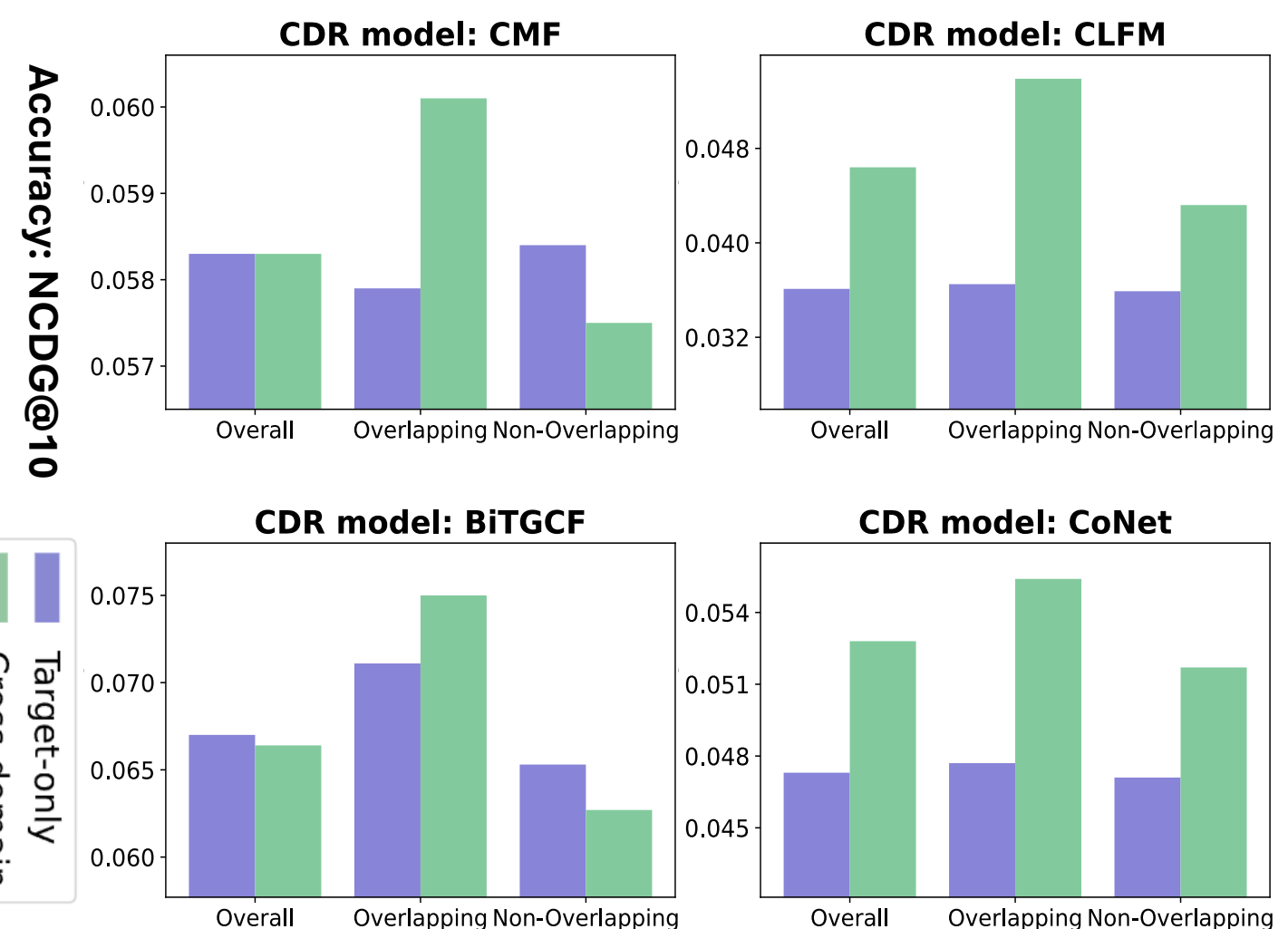
² Shenzhen University



Research Problem: Unfairness in Cross-Domain Recommendation

- Cross-domain recommendation (CDR)** leverages **overlapping users** to transfer knowledge from the source domain and improve target-domain performance.
- CDR overlapping bias: non-overlapping users** see less improvement or even performance degradation compared to overlapping users.

This unfairness may erode user trust, and, consequently, negatively impact business engagement and revenue.



Methodology

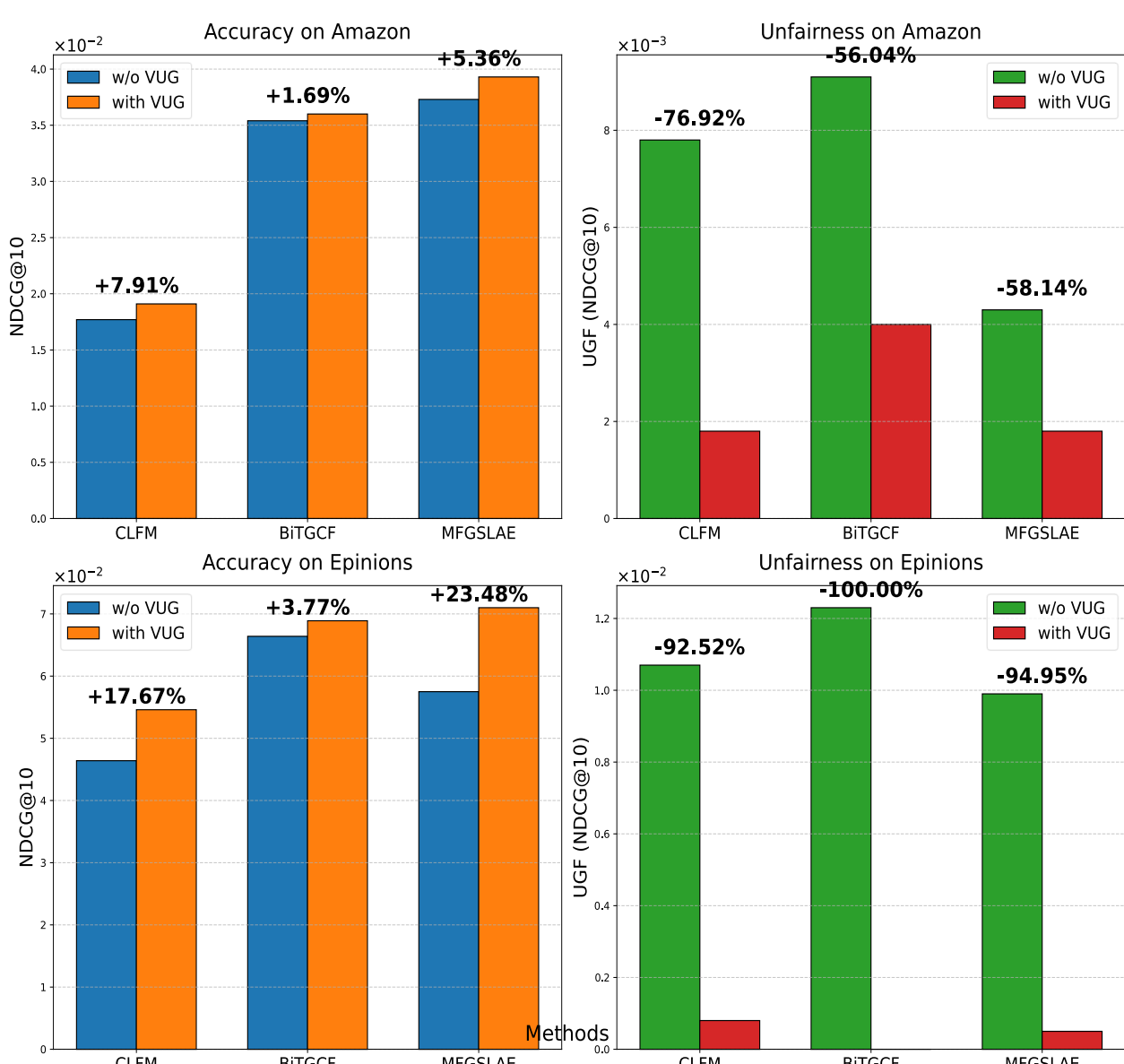
Key idea: generate the source embeddings for **non-overlapping users** in target domain, so they can also enjoy CDR learning:

$$\mathbf{e}_{\text{non}}^{S'} = \sum_{u \in \mathcal{U}^o} \alpha_u (\mathbf{W}_v \mathbf{e}_u^S + \mathbf{b}_v)$$

Virtual source embeddings for non-overlapping users in target domain

Experiments

RQ1: Overall Performance



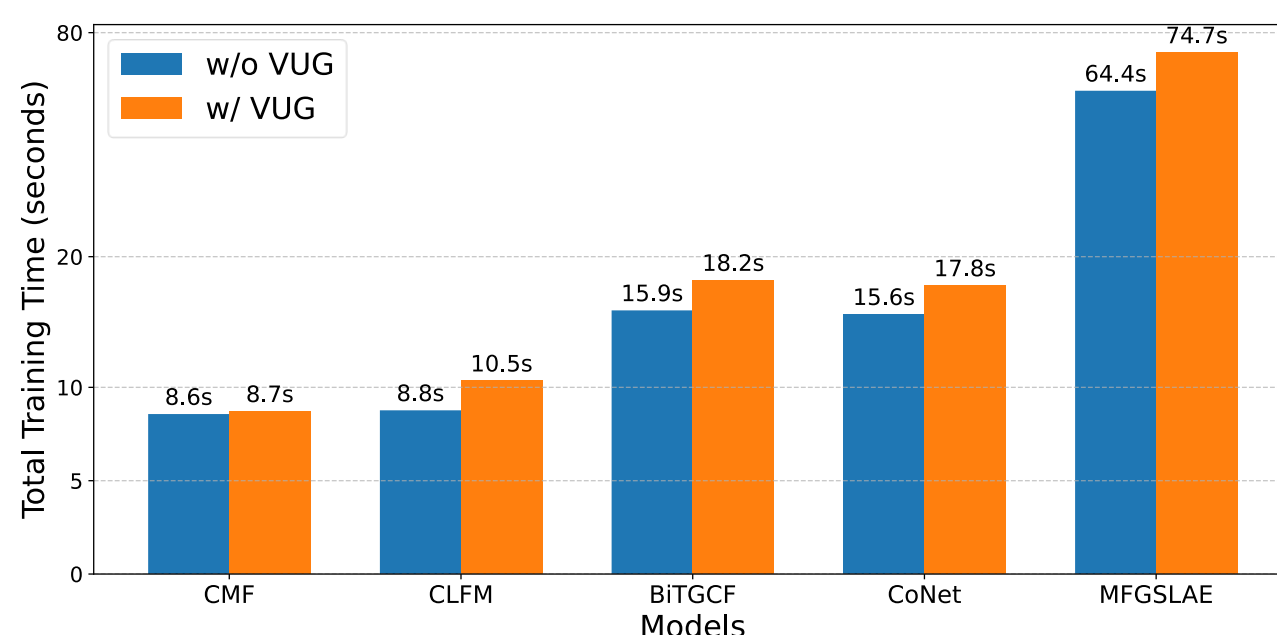
UGF measures **absolute accuracy difference** (e.g., NCDG@10) between overlapping and non-overlapping users.

RQ2: Ablation Study

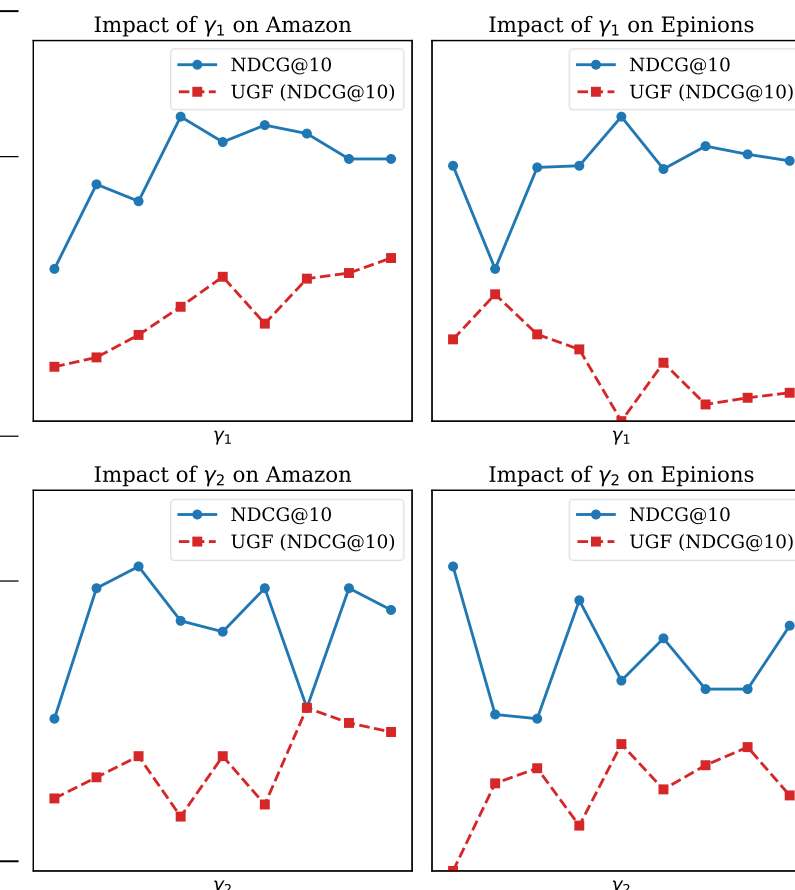
Method	Accuracy (larger is better)			
	HR@10	HR@20	NDCG@10	NDCG@20
w/o $\mathcal{L}_{\text{constrain}}$	0.1302	0.1974	0.0655	0.0821
w/o $\mathcal{L}_{\text{super}}$	0.1355	0.1985	0.0707	0.0864
w/o α_u^{user}	0.1298	0.1974	0.0662	0.0828
w/o α_u^{item}	0.1287	0.1963	0.0658	0.0824
VUG	0.1363	0.2001	0.0710	0.0865

Method	UGF (smaller is better)			
	HR@10	HR@20	NDCG@10	NDCG@20
w/o $\mathcal{L}_{\text{constrain}}$	0.0010	0.0168	0.0005	0.0033
w/o $\mathcal{L}_{\text{super}}$	0.0281	0.0152	0.0129	0.0096
w/o α_u^{user}	0.0020	0.0095	0.0015	0.0034
w/o α_u^{item}	0.0041	0.0112	0.0005	0.0035
VUG	0.0003	0.0015	0.0005	0.0014

RQ4: Efficiency



RQ3: Parameter Sensitivity



About me:

