TABLE I: Ablation Study for Different Attention Layers on Bookcrossing

Blocks	User Cold-Start			Item Cold-Start			User & Item Cold-Start		
	Pre.@5	NDCG@5	MAP@5	Pre.@5	NDCG@5	MAP@5	Pre.@5	NDCG@5	MAP@5
wo/ Item & Attribute	0.4809	0.8381	0.3614	0.5562	0.8678	0.4565	0.5205	0.8571	0.4620
wo/ User & Attribute	0.4868	0.8445	0.4199	0.5878	0.8907	0.5324	0.5535	0.9056	0.4967
wo/ User & Item	0.4816	0.8448	0.3969	0.5853	0.8757	0.5442	0.5586	0.9041	0.5198
wo/ User	0.4997	0.8445	0.3736	0.5512	0.8716	0.4857	0.5660	0.8945	0.5172
wo/ Item	0.4634	0.8474	0.3814	0.5147	0.8701	0.4415	0.5440	0.8630	0.4809
wo/ Attribute	0.4506	0.8434	0.3741	0.5146	0.8675	0.4412	0.5375	0.8575	0.4755
full model	**0.5102**	**0.8596**	**0.4213**	**0.6183**	**0.8926**	**0.5465**	**0.6350**	**0.9061**	**0.5697**

TABLE II: Ablation Study for Different Attention Layers on Douban

Blocks	User Cold-Start			Item Cold-Start			User & Item Cold-Start		
	Pre.@5	NDCG@5	MAP@5	Pre.@5	NDCG@5	MAP@5	Pre.@5	NDCG@5	MAP@5
wo/ Item & Attribute	0.6336	0.9016	0.5658	0.5060	0.8577	0.4307	0.5443	0.8604	0.4808
wo/ User & Attribute	0.6378	0.9062	0.5695	0.5317	0.8698	0.4610	0.5338	0.8588	0.4735
wo/ User & Item	0.6440	0.9049	0.5787	0.4903	0.8535	0.4151	0.5423	0.8519	0.4736
wo/ User	0.6352	0.9020	0.5663	0.5324	0.8716	0.4649	0.5674	0.8789	0.4700
wo/ Item	0.6322	0.9007	0.5657	0.5049	0.8556	0.4300	0.5821	0.8762	0.4698
wo/ Attribute	0.6346	0.9021	0.5671	0.5039	0.8565	0.4260	0.5746	0.8681	0.4807
full model	**0.6763**	**0.9141**	**0.6000**	**0.5639**	**0.8765**	**0.4764**	**0.6241**	**0.8821**	**0.4816**

TABLE III: P-value of Wilcoxon Rank-Sum Test in Three Cold-Start Scenarios on MovieLens-1M

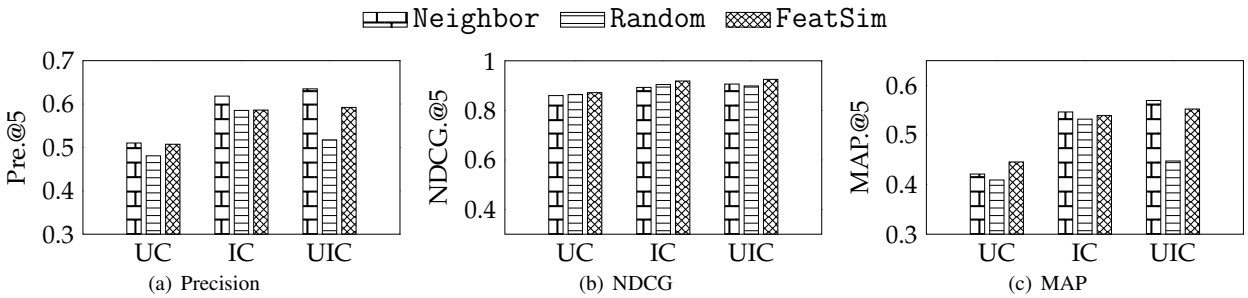
Scenarios	Methods	TOP5			TOP7			TOP10		
		Precision	NDCG	MAP	Precision	NDCG	MAP	Precision	NDCG	MAP
User cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	GraphHINGE	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	MetaHIN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	MAMO	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	TaNP	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0147	0.0143
Item cold-start	NeuMF	0.0143	0.0143	0.0571	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	GraphHINGE	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MetaHIN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MAMO	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	TaNP	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0571	0.0147	0.0143
User & item cold-start	NeuMF	0.0143	0.0143	0.0143	0.0147	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	GraphHINGE	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MetaHIN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MAMO	0.0143	0.0147	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	TaNP	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143

TABLE IV: P-value of Wilcoxon Rank-Sum Test in Three Cold-Start Scenarios on Bookcrossing

Scenarios	Methods	TOP5			TOP7			TOP10		
		Precision	NDCG	MAP	Precision	NDCG	MAP	Precision	NDCG	MAP
User cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147
	DeepFM	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147
	AFN	0.0147	0.0147	0.0143	0.0147	0.0147	0.0147	0.0147	0.0147	0.0147
	MAMO	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.5571	0.0143	0.3429
	TaNP	0.0143	0.0286	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0286	0.0143	0.0143
Item cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0286	0.0143	0.0143	0.0286	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.1000	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MAMO	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.5571	0.0143	0.5571
	TaNP	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.1000	0.0143	0.0286
User & item cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MAMO	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.1000	0.0143	0.1000
	TaNP	0.0143	0.5571	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0286	0.0143	0.0286

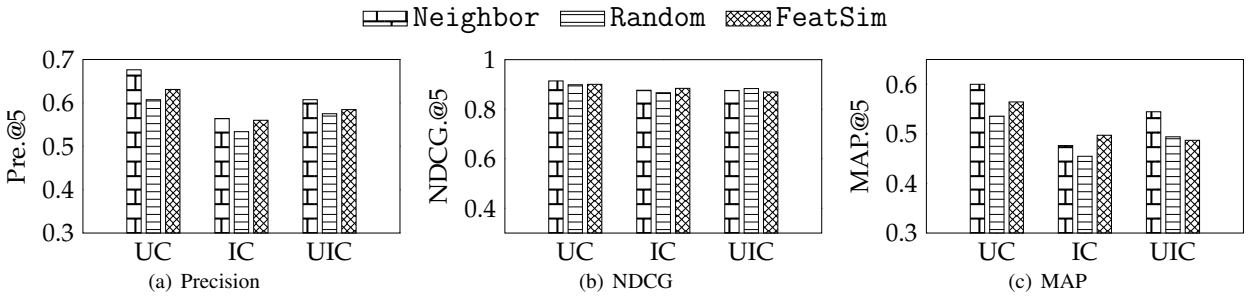
TABLE V: P-value of Wilcoxon Rank-Sum Test in Three Cold-Start Scenarios on Douban

Scenarios	Methods	TOP5			TOP7			TOP10		
		Precision	NDCG	MAP	Precision	NDCG	MAP	Precision	NDCG	MAP
User cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	GraphRec	0.0143	0.0143	0.0143	0.8286	0.0143	0.9714	1.0000	0.0143	1.0000
	MAMO	0.0147	0.0143	0.0143	0.0143	0.0143	0.0143	0.1714	0.0147	0.0147
	TaNP	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.1714	0.0143	0.0571
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
Item cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	GraphRec	0.0143	0.0143	0.0147	0.0143	0.0147	0.0147	0.0147	0.0147	0.0147
	MAMO	0.1714	0.0143	0.1714	0.9000	0.0147	0.1714	1.0000	0.0143	1.0000
	TaNP	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0286	0.0143	0.0143	0.1714	0.0143	0.1000
User & item cold-start	NeuMF	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	Wide&Deep	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	DeepFM	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	AFN	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	GraphRec	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143
	MAMO	0.0143	0.0143	0.1714	0.0286	0.0147	0.0143	0.9000	0.0143	0.5571
	TaNP	0.1714	0.0571	0.1000	0.5571	0.1714	0.0286	0.3429	0.0286	0.0143
	MeLU	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143	0.0143



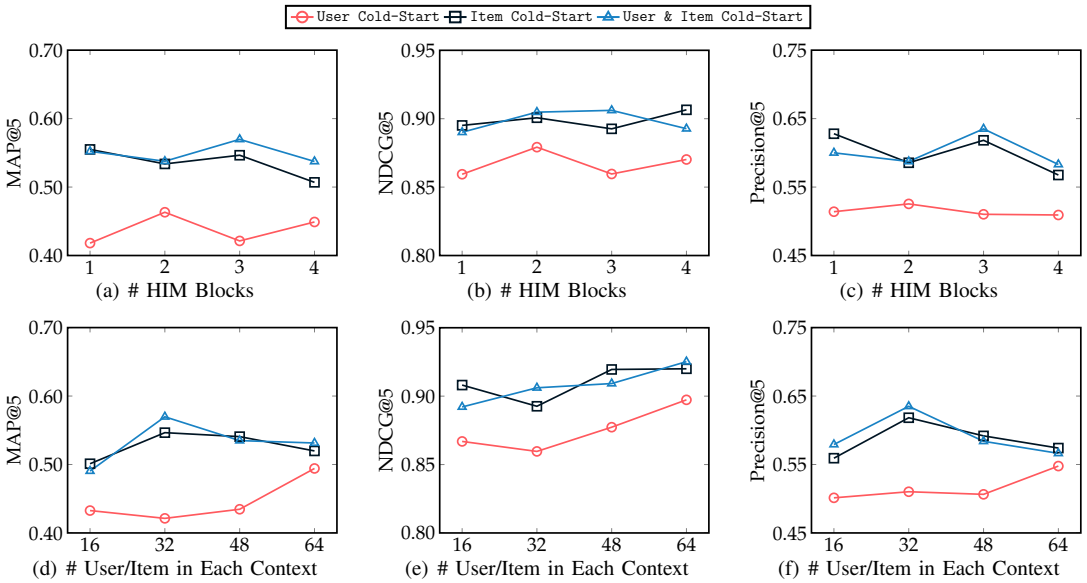
(a) Precision (b) NDCG (c) MAP

Fig. 1: Impact of sampling methods on Bookcrossing



(a) Precision (b) NDCG (c) MAP

Fig. 2: Impact of sampling methods on Douban



(a) # HIM Blocks (b) # HIM Blocks (c) # HIM Blocks

(d) # User/Item in Each Context (e) # User/Item in Each Context (f) # User/Item in Each Context

Fig. 3: Sensitivity Analysis on Bookcrossing

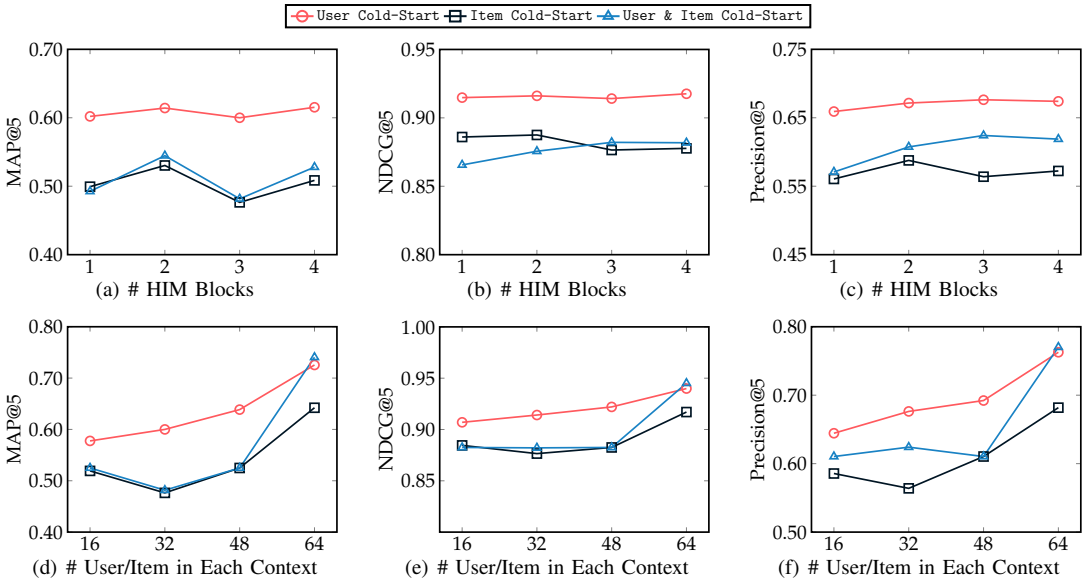


Fig. 4: Sensitivity Analysis on Douban