RecSys2024-LDRI-Rebuttal-Hyper Parameters

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Regarding the hyperparameters utilized in our study, we incorporated three significant hyperparameters: N, α, and β. These hyperparameters were employed for facilitating the learning of smooth recency-sensitivity representation, achieving a balance in training between two tasks, and integrating matching scores with recency-sensitivity, respectively.

In the following sections, we conducted hyperparameter experiments on three hyperparameters to assess the impact of different values on recommendation outcomes. Section 1, Section 2, and Section 3 correspond to the hyperparameter experiments for N, α, and β, respectively.

1 HYPER-PARAMETERS TEST OF *N*

In this section, we examine the impact of different values of $N(N = 1, 2, 3)$ on the recommendation results. In Section 1.1, we present the overall performance of the recommendation results. In Section 1.2, we provide the NDCG@5 results on KuaiRand-Pure and NDCG@300 results on KuaiRand-1K at each release interval with three backbones and the enhanced version with LDRI. In Section 1.3, we demonstrate the performance of the model in cold-start scenarios. The experimental setup for the cold-start scenarios is consistent with that in our main text. For all experiments, we fix $\alpha = 0.6$ and $\beta = 0.5$.

1.1 Overall Performance

In this section, we present the overall recommendation performance. Our experimental results indicate that on the KuaiRand-Pure dataset, LDRI's performance is minimally affected by variations in N. However, on the KuaiRand-1K dataset, LDRI's performance is significantly impacted by N. The model achieves optimal performance with smaller values of N, particularly at $N = 1$. Therefore, we set $N = 1$ in our main text. However, the performance decreases noticeably at $N = 3$. This suggests that the KuaiRand-1K dataset exhibits rapid changes in video timeliness, requiring more granular modeling of temporal dynamics. Despite this decline, LDRI still surpasses the backbone model.

For further details, please refer to Table 1 below.

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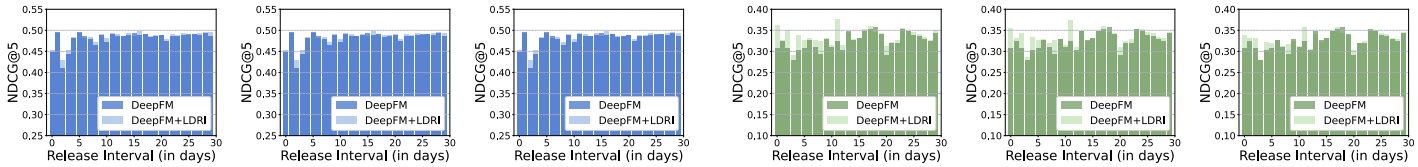
Table 1. Overall TopK recommendation results on KuaiRand-Pure and KuaiRand-1K. We compare different methods' performances using standard TopK recommendation metrics: RECALL@K, MAP@K, NDCG@K, and HR@K. We fix $\alpha = 0.6$ and $\beta = 0.5$, and compare the recommendation performance with different values of N ($N = 1, 2, 3$). The recommendation results of the backbones (DeepFM, NFM and AFM) are not affected by the values of the hyperparameters of LDRI.

Dataset	Method	RECALL@5			MAP@5			NDCG@5			HR@5		
		$N=1$	$N=2$	$N=3$	$N=1$	$N=2$	$N=3$	$N=1$	$N=2$	$N=3$	$N=1$	$N=2$	$N=3$
KuaiRand-Pure	DeepFM		0.6722			0.4829			0.3232			0.8122	
	DeepFM+LDRI **(Ours)**	0.7157	0.7174	0.7175	0.5252	0.5262	0.5264	0.3480	0.3488	0.3489	0.8490	0.8505	0.8509
	DeepFM+LDRI-iter **(Ours)**	0.7164	0.7180	0.7183	0.5262	0.5262	0.5263	0.3485	0.3488	0.3489	0.8490	0.8508	0.8511
	NFM		0.5426			0.3563			0.2493			0.6970	
	NFM+LDRI **(Ours)**	0.6912	0.6928	0.6926	0.5024	0.5034	0.5029	0.3346	0.3352	0.3350	0.8298	0.8313	0.8307
	NFM+LDRI-iter **(Ours)**	0.6925	0.6921	0.6917	0.5026	0.5029	0.5017	0.3348	0.3349	0.3343	0.8303	0.8306	0.8302
	AFM		0.6444			0.4565			0.3091			0.7888	
	AFM+LDRI **(Ours)**	0.7138	0.7141	0.7137	0.5206	0.5207	0.5203	0.3454	0.3459	0.3451	0.8487	0.8491	0.8488
	AFM+LDRI-iter **(Ours)**	0.7140	0.7139	0.7136	0.5208	0.5209	0.5204	0.3456	0.3460	0.3458	0.8484	0.8486	0.8481
KuaiRand-1K		RECALL@300			MAP@300			NDCG@300			HR@300		
		$N=1$	$N=2$	$N=3$	$N=1$	$N=2$	$N=3$	$N=1$	$N=2$	$N=3$	$N=1$	$N=2$	$N=3$
	DeepFM		0.4242			0.0574			0.2171			0.9743	
	DeepFM+LDRI **(Ours)**	0.4670	0.4641	0.4427	0.0863	0.0821	0.0726	0.2639	0.2576	0.2419	0.9846	0.9825	0.9773
	DeepFM+LDRI-iter **(Ours)**	0.4689	0.4642	0.4409	0.0869	0.0834	0.0714	0.2649	0.2589	0.2398	0.9846	0.9825	0.9773
	NFM		0.3479			0.0557			0.1958			0.9526	
	NFM+LDRI **(Ours)**	0.3993	0.3971	0.3900	0.0735	0.0712	0.0696	0.2309	0.2288	0.2235	0.9660	0.9663	0.9670
	NFM+LDRI-iter **(Ours)**	0.4008	0.3969	0.3881	0.0737	0.0712	0.0672	0.2308	0.2271	0.2192	0.9701	0.9680	0.9640
	AFM		0.4000			0.0842			0.2466			0.9681	
	AFM+LDRI **(Ours)**	0.4840	0.4822	0.4820	0.1020	0.1017	0.1012	0.2888	0.2885	0.2880	0.9845	0.9841	0.9835
	AFM+LDRI-iter **(Ours)**	0.4854	0.4829	0.4823	0.1022	0.1017	0.1011	0.2889	0.2883	0.2878	0.9835	0.9830	0.9823

1.2 Performance across Release Intervals

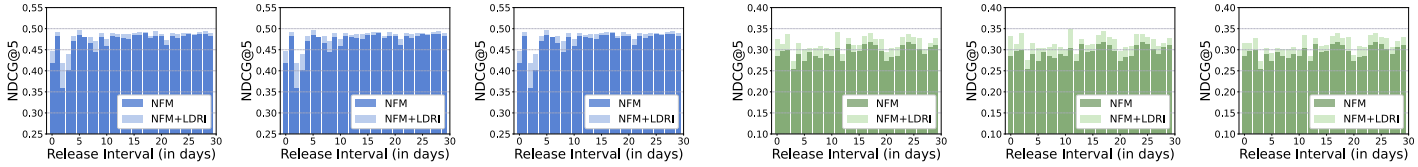
In this section, we compare the performance of the backbone models and the backbones enhanced with LDRI across all release intervals on the KuaiRand-Pure and KuaiRand-1K datasets. Consistent with the conclusions in Section 1.1, setting $N = 3$ results in an overall performance decline on the KuaiRand-1K dataset. However, they still outperforms the backbone models across all release intervals.

For further details, please refer to Figures 1-3 below.



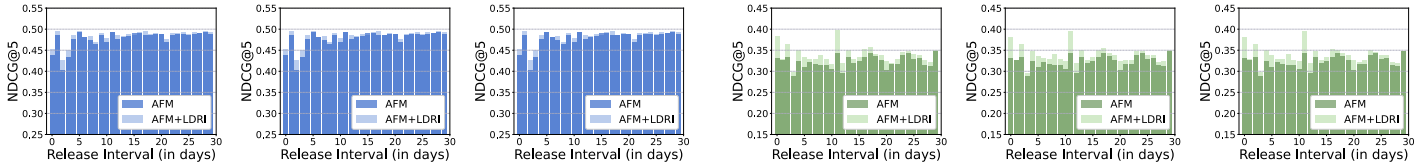
(a) DeepFM on Pure ($N = 1$) (b) DeepFM on Pure ($N = 2$) (c) DeepFM on Pure ($N = 3$) (d) DeepFM on 1K ($N = 1$) (e) DeepFM on 1K ($N = 2$) (f) DeepFM on 1K ($N = 3$)

Fig. 1. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with DeepFM and DeepFM enhanced version with LDRI. We fix $\alpha = 0.6$ and $\beta = 0.5$ to examine the recommendation differences with $N = 1, 2, 3$.



(a) NFM on Pure ($N = 1$) (b) NFM on Pure ($N = 2$) (c) NFM on Pure ($N = 3$) (d) NFM on 1K ($N = 1$) (e) NFM on 1K ($N = 2$) (f) NFM on 1K ($N = 3$)

Fig. 2. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with NFM and NFM enhanced version with LDRI. We fix $\alpha = 0.6$ and $\beta = 0.5$ to examine the recommendation differences with $N = 1, 2, 3$.



(a) AFM on Pure ($N = 1$) (b) AFM on Pure ($N = 2$) (c) AFM on Pure ($N = 3$) (d) AFM on 1K ($N = 1$) (e) AFM on 1K ($N = 2$) (f) AFM on 1K ($N = 3$)

Fig. 3. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with AFM and AFM enhanced version with LDRI. We fix $\alpha = 0.6$ and $\beta = 0.5$ to examine the recommendation differences with $N = 1, 2, 3$.

1.3 Cold Start Setting

In this section, we present the experimental results for the cold start scenario. As outlined in the main text, we conducted cold start experiments exclusively on the KuaiRand-1K dataset, since the fixed item pool configuration of the KuaiRand-Pure dataset renders it unsuitable for this type of experiment. The conclusions are broadly consistent with those presented in Sections 1.1 and 1.2.

For further details, please refer to Table 2.

Table 2. TopK recommendation results under cold start conditions assessed on the KuaiRand-1K dataset. We fix $\alpha = 0.6$ and $\beta = 0.5$, and compare the recommendation performance with different values of N ($N = 1, 2, 3$). The recommendation results of the backbones (DeepFM, NFM and AFM) are not affected by the values of the hyperparameters. Consistent with the main text, cold-start experiments are not suitable for the KuaiRand-Pure dataset because its items originate from a fixed item pool.

Dataset	Method	RECALL@300			MAP@300			NDCG@300			HR@300		
		$N = 1$	$N = 2$	$N = 3$	$N = 1$	$N = 2$	$N = 3$	$N = 1$	$N = 2$	$N = 3$	$N = 1$	$N = 2$	$N = 3$
KuaiRand-1K	DeepFM		0.8332			0.1422			0.3343			0.9875	
	DeepFM+LDRI **(Ours)**	0.8483	0.8643	0.8365	0.1865	0.1820	0.1647	0.3781	0.3752	0.3598	0.9886	0.9920	0.9818
	DeepFM+LDRI-iter **(Ours)**	0.8490	0.8556	0.8344	0.1877	0.1826	0.1632	0.3803	0.3760	0.3579	0.9864	0.9932	0.9818
	NFM		0.7468			0.1248			0.3033			0.9739	
	NFM+LDRI **(Ours)**	0.7972	0.8000	0.7775	0.1592	0.1641	0.1550	0.3431	0.3481	0.3356	0.9852	0.9818	0.9727
	NFM+LDRI-iter **(Ours)**	0.7944	0.7962	0.7721	0.1594	0.1622	0.1511	0.3429	0.3455	0.3315	0.9841	0.9818	0.9727
	AFM		0.7784			0.1676			0.3474			0.9750	
	AFM+LDRI **(Ours)**	0.8651	0.8665	0.8654	0.2115	0.2117	0.2114	0.3990	0.3978	0.3977	0.9875	0.9932	0.9932
	AFM+LDRI-iter **(Ours)**	0.8633	0.8662	0.8656	0.2088	0.2099	0.2095	0.3965	0.3969	0.3965	0.9886	0.9932	0.9930

2 HYPER-PARAMETERS TEST OF α

In this section, we examine the impact of different values of $\alpha(\alpha = 0.4, 0.5, 0.6)$ on the recommendation results. In Section 2.1, we present the overall performance of the recommendation results. In Section 2.2, we provide the NDCG@5 results on KuaiRand-Pure and NDCG@300 results on KuaiRand-1K at each release interval with three backbones and the enhanced version with LDRI. In Section 2.3, we demonstrate the performance of the model in cold-start scenarios. The experimental setup for the cold-start scenarios is consistent with that in our main text. For all experiments, we fix $N = 1$ and $\beta = 0.5$.

2.1 Overall Performance

In this section, we present the overall recommendation performance. Our experimental results indicate that on the KuaiRand-Pure and KuaiRand-1K datasets, LDRI's performance is minimally affected by variations in α. This phenomenon may stem from the optimization algorithm having reached a relatively stable state during training. Minor adjustments in α are unlikely to significantly alter the direction and magnitude of model parameter updates, thereby maintaining consistent overall performance. Therefore, we set $\alpha = 0.6$ in the main text. Moreover, regardless of the value of α, LDRI consistently enhances the performance of the backbone model significantly. This observation robustly underscores the superior efficacy and resilience of our LDRI model with respect to hyperparameter tuning.

For further details, please refer to Table 3 below.

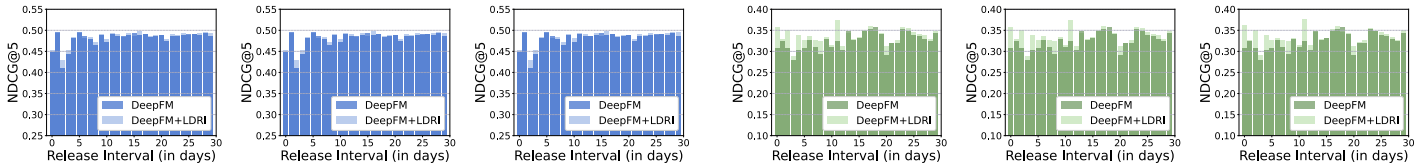
Table 3. Overall TopK recommendation results on KuaiRand-Pure and KuaiRand-1K. We compare different methods' performances using standard TopK recommendation metrics: RECALL@K, MAP@K, NDCG@K, and HR@K. We fix $N = 1$ and $\beta = 0.5$, and compare the recommendation performance with different values of α ($\alpha = 0.4, 0.5, 0.6$). The recommendation results of the backbones (DeepFM, NFM and AFM) are not affected by the values of the hyperparameters of LDRI.

Dataset	Method	RECALL@5			MAP@5			NDCG@5			HR@5		
		$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$
KuaiRand-Pure	DeepFM		0.6722			0.4829			0.3232			0.8122	
	DeepFM+LDRI **(Ours)**	0.7161	0.7155	0.7157	0.5257	0.5252	0.5252	0.3484	0.3480	0.3480	0.8497	0.8490	0.8490
	DeepFM+LDRI-iter **(Ours)**	0.7176	0.7166	0.7164	0.5255	0.5260	0.5262	0.3489	0.3485	0.3485	0.8504	0.8490	0.8490
	NFM		0.5426			0.3563			0.2493			0.6970	
	NFM+LDRI **(Ours)**	0.6910	0.6919	0.6912	0.5022	0.5019	0.5024	0.3344	0.3351	0.3346	0.8310	0.8305	0.8298
	NFM+LDRI-iter **(Ours)**	0.6929	0.6920	0.6925	0.5024	0.5021	0.5026	0.3347	0.3350	0.3348	0.8314	0.8310	0.8303
	AFM **(Ours)**		0.6444			0.4565			0.3091			0.7888	
	AFM+LDRI **(Ours)**	0.7130	0.7139	0.7138	0.5210	0.5200	0.5206	0.3452	0.3461	0.3454	0.8490	0.8486	0.8487
	AFM+LDRI-iter **(Ours)**	0.7138	0.7139	0.7140	0.5213	0.5203	0.5208	0.3453	0.3464	0.3456	0.8489	0.8492	0.8484
KuaiRand-1K		RECALL@300			MAP@300			NDCG@300			HR@300		
		$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$
	DeepFM		0.4242			0.0574			0.2171			0.9743	
	DeepFM+LDRI **(Ours)**	0.4658	0.4665	0.4670	0.0857	0.0860	0.0863	0.2616	0.2625	0.2639	0.9866	0.9850	0.9846
	DeepFM+LDRI-iter **(Ours)**	0.4663	0.4677	0.4689	0.0861	0.0865	0.0869	0.2613	0.2622	0.2649	0.9866	0.9850	0.9846
	NFM		0.3479			0.0557			0.1958			0.9526	
	NFM+LDRI **(Ours)**	0.3981	0.3989	0.3993	0.0729	0.0732	0.0735	0.2282	0.2294	0.2309	0.9770	0.9766	0.9660
	NFM+LDRI-iter **(Ours)**	0.3995	0.4000	0.4008	0.0733	0.0735	0.0737	0.2280	0.2299	0.2308	0.9770	0.9766	0.9701
	AFM		0.4000			0.0842			0.2466			0.9681	
	AFM+LDRI **(Ours)**	0.4822	0.4819	0.4840	0.1011	0.1016	0.1020	0.2870	0.2883	0.2888	0.9844	0.9844	0.9845
	AFM+LDRI-iter **(Ours)**	0.4830	0.4827	0.4854	0.1011	0.1017	0.1022	0.2871	0.2890	0.2889	0.9831	0.9836	0.9835

2.2 Performance across Release Intervals

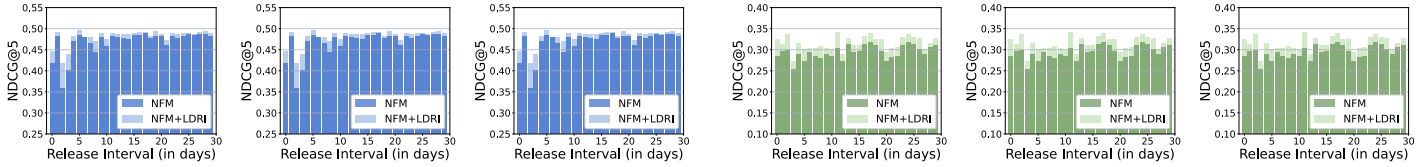
In this section, we compare the performance of the backbone models and the backbones enhanced with LDRI across all release intervals on the KuaiRand-Pure and KuaiRand-1K datasets. Consistent with the conclusions in Section 2.1, the value of α did not yield significant impacts on the recommendation outcome, and LDRI still outperforms the backbone models across all release intervals.

For further details, please refer to Figures 4-6 below.



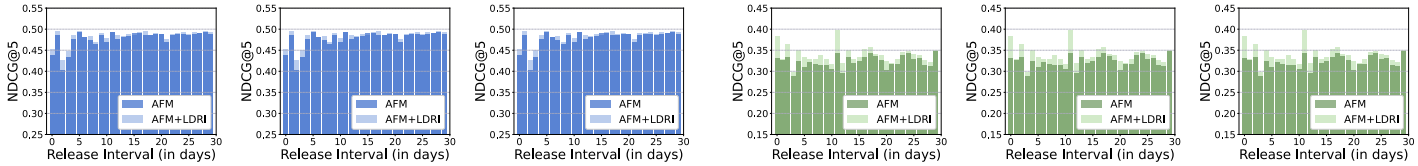
(a) DeepFM on Pure ($\alpha = 0.4$) (b) DeepFM on Pure ($\alpha = 0.5$) (c) DeepFM on Pure ($\alpha = 0.6$) (d) DeepFM on 1K ($\alpha = 0.4$) (e) DeepFM on 1K ($\alpha = 0.5$) (f) DeepFM on 1K ($\alpha = 0.6$)

Fig. 4. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with DeepFM and DeepFM enhanced version with LDRI. We fix $N = 1$ and $\beta = 0.5$ to examine the recommendation differences with $\alpha = 0.4, 0.5, 0.6$.



(a) NFM on Pure ($\alpha = 0.4$) (b) NFM on Pure ($\alpha = 0.5$) (c) NFM on Pure ($\alpha = 0.6$) (d) NFM on 1K ($\alpha = 0.4$) (e) NFM on 1K ($\alpha = 0.5$) (f) NFM on 1K ($\alpha = 0.6$)

Fig. 5. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with NFM and NFM enhanced version with LDRI. We fix $N = 1$ and $\beta = 0.5$ to examine the recommendation differences with $\alpha = 0.4, 0.5, 0.6$.



(a) AFM on Pure ($\alpha = 0.4$) (b) AFM on Pure ($\alpha = 0.5$) (c) AFM on Pure ($\alpha = 0.6$) (d) AFM on 1K ($\alpha = 0.4$) (e) AFM on 1K ($\alpha = 0.5$) (f) AFM on 1K ($\alpha = 0.6$)

Fig. 6. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with AFM and AFM enhanced version with LDRI. We fix $N = 1$ and $\beta = 0.5$ to examine the recommendation differences with $\alpha = 0.4, 0.5, 0.6$.

2.3 Cold Start Setting

In this section, we present the experimental results for the cold start scenario. As outlined in the main text, we conducted cold start experiments exclusively on the KuaiRand-1K dataset, since the fixed item pool configuration of the KuaiRand-Pure dataset renders it unsuitable for this type of experiment. The conclusions are broadly consistent with those presented in Sections 2.1 and 2.2.

For further details, please refer to Table 4.

Table 4. TopK recommendation results under cold start conditions assessed on the KuaiRand-1K dataset. We fix $N = 1$ and $\beta = 0.5$, and compare the recommendation performance with different values of α ($\alpha = 0.4, 0.5, 0.6$). The recommendation results of the backbones (DeepFM, NFM and AFM) are not affected by the values of the hyperparameters. Consistent with the main text, cold-start experiments are not suitable for the KuaiRand-Pure dataset because its items originate from a fixed item pool.

Dataset	Method	RECALL@300			MAP@300			NDCG@300			HR@300		
		$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$	$\alpha = 0.4$	$\alpha = 0.5$	$\alpha = 0.6$
KuaiRand-1K	DeepFM		0.8332			0.1422			0.3343			0.9875	
	DeepFM+LDRI **(Ours)**	0.8443	0.8462	0.8483	0.1850	0.1845	0.1865	0.3765	0.3771	0.3781	0.9886	0.9864	0.9886
	DeepFM+LDRI-iter **(Ours)**	0.8418	0.8447	0.8490	0.1857	0.1836	0.1877	0.3769	0.3772	0.3803	0.9886	0.9852	0.9864
	NFM		0.7468			0.1248			0.3033			0.9739	
	NFM+LDRI **(Ours)**	0.7941	0.7959	0.7972	0.1571	0.1590	0.1592	0.3402	0.3426	0.3431	0.9830	0.9841	0.9852
	NFM+LDRI-iter **(Ours)**	0.7922	0.8885	0.7944	0.1582	0.1590	0.1594	0.3406	0.3422	0.3429	0.9830	0.9841	0.9841
	AFM		0.7784			0.1676			0.3474			0.9750	
	AFM+LDRI **(Ours)**	0.8655	0.8637	0.8651	0.2127	0.2092	0.2115	0.3993	0.3970	0.3990	0.9898	0.9875	0.9875
	AFM+LDRI-iter **(Ours)**	0.8637	0.8651	0.8633	0.2109	0.2077	0.2088	0.3974	0.3955	0.3965	0.9898	0.9898	0.9886

3 HYPER-PARAMETERS TEST OF β

In this section, we examine the impact of different values of $\beta(\beta = 0.4, 0.5, 0.6)$ on the recommendation results. In Section 3.1, we present the overall performance of the recommendation results. In Section 3.2, we provide the NDCG@5 results on KuaiRand-Pure and NDCG@300 results on KuaiRand-1K at each release interval with three backbones and the enhanced version with LDRI. In Section 3.3, we demonstrate the performance of the model in cold-start scenarios. The experimental setup for the cold-start scenarios is consistent with that in our main text. For all experiments, we fix $N = 1$ and $\alpha = 0.6$.

3.1 Overall Performance

In this section, we present the overall recommendation performance. Our experimental results indicate that on the KuaiRand-Pure and KuaiRand-1K datasets, LDRI's performance is minimally affected by variations in β. Hence, we set $\beta = 0.5$ in the main text. Moreover, regardless of the value of β, LDRI consistently enhances the performance of the backbone model significantly. This observation underscores the superior efficacy and robustness of LDRI.

For further details, please refer to Table 5 below.

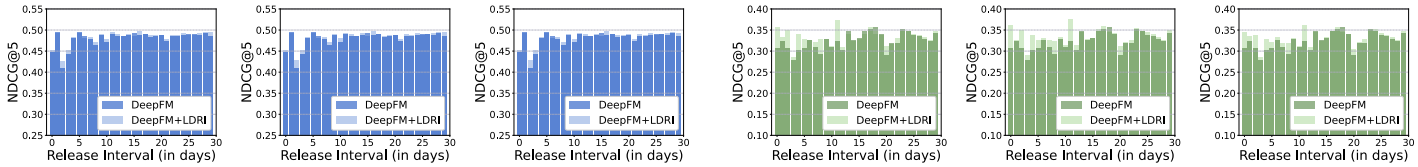
Table 5. Overall TopK recommendation results on KuaiRand-Pure and KuaiRand-1K. We compare different methods' performances using standard TopK recommendation metrics: RECALL@K, MAP@K, NDCG@K, and HR@K. We fix $N = 1$ and $\alpha = 0.6$, and compare the recommendation performance with different values of β ($\beta = 0.4, 0.5, 0.6$). The recommendation results of the backbones (DeepFM, NFM and AFM) are not affected by the values of the hyperparameters of LDRI.

Dataset	Method	RECALL@5			MAP@5			NDCG@5			HR@5		
		$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$
KuaiRand-Pure	DeepFM		0.6722			0.4829			0.3232			0.8122	
	DeepFM+LDRI **(Ours)**	0.7153	0.7157	0.7173	0.5246	0.5252	0.5256	0.3478	0.3480	03485	0.8490	0.8490	0.8506
	DeepFM+LDRI-iter **(Ours)**	0.7165	0.7164	0.7168	0.5259	0.5262	0.5257	0.3485	0.3485	0.3484	0.8497	0.8490	0.8498
	NFM		0.5426			0.3563			0.2493			0.6970	
	NFM+LDRI **(Ours)**	0.6838	0.6912	0.6837	0.4962	0.5024	0.4961	0.3307	0.3346	0.3306	0.8239	0.8298	0.8241
	NFM+LDRI-iter **(Ours)**	0.6842	0.6925	0.6854	0.4986	0.5026	0.4961	0.3307	0.3348	0.3306	0.8242	0.8303	0.8233
	AFM		0.6444			0.4565			0.3091			0.7888	
	AFM+LDRI **(Ours)**	0.7143	0.7138	0.7134	0.5213	0.5206	0.5182	0.3460	0.3454	0.3442	0.8493	0.8487	0.8488
	AFM+LDRI-iter **(Ours)**	0.7133	0.7140	0.7127	0.5203	0.5208	0.5178	0.3454	0.3456	0.3439	0.8479	0.8484	0.8476
KuaiRand-1K		RECALL@300			MAP@300			NDCG@300			HR@300		
		$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$
	DeepFM		0.4242			0.0574			0.2171			0.9743	
	DeepFM+LDRI **(Ours)**	0.4609	0.4670	0.4491	0.0861	0.0863	0.0769	0.2613	0.2639	0.2481	0.9846	0.9846	0.9835
	DeepFM+LDRI-iter **(Ours)**	0.4587	0.4689	0.4485	0.0856	0.0869	0.0768	0.2600	0.2649	0.2476	0.9825	0.9846	0.9846
	NFM		0.3479			0.0557			0.1958			0.9526	
	NFM+LDRI **(Ours)**	0.4032	0.3993	0.3825	0.0710	0.0735	0.0675	0.2297	0.2309	0.2195	0.9650	0.9660	0.9650
	NFM+LDRI-iter **(Ours)**	0.4077	0.4008	0.3850	0.0733	0.0737	0.0692	0.2333	0.2308	0.2220	0.9640	0.9701	0.9650
	AFM		0.4000			0.0842			0.2466			0.9681	
	AFM+LDRI **(Ours)**	0.4945	0.4840	0.4788	0.1060	0.1020	0.1004	0.2955	0.2888	0.2849	0.9876	0.9845	0.9825
	AFM+LDRI-iter **(Ours)**	0.4985	0.4854	0.4784	0.1061	0.1022	0.1003	0.2961	0.2889	0.2847	0.9856	0.9835	0.9825

3.2 Performance across Release Intervals

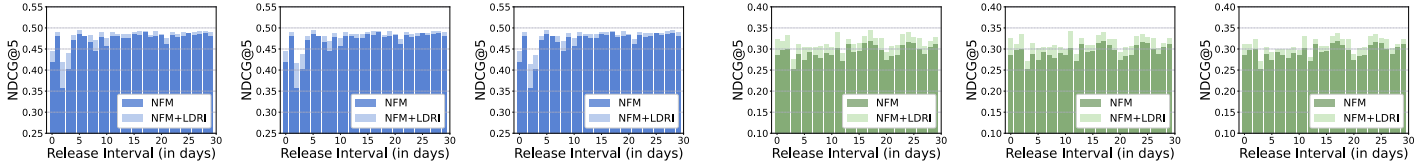
In this section, we compare the performance of the backbone models and the backbones enhanced with LDRI across all release intervals on the KuaiRand-Pure and KuaiRand-1K datasets. Consistent with the conclusions in Section 3.1, the value of β did not yield significant impacts on the recommendation outcome, and LDRI still outperforms the backbone models across all release intervals.

For furtuer details, please refer to Figures 7-9 below.



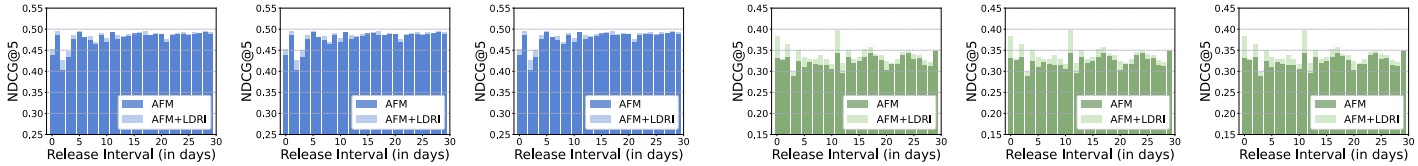
(a) DeepFM on Pure ($\beta = 0.4$) (b) DeepFM on Pure ($\beta = 0.5$) (c) DeepFM on Pure ($\beta = 0.6$) (d) DeepFM on 1K ($\beta = 0.4$) (e) DeepFM on 1K ($\beta = 0.5$) (f) DeepFM on 1K ($\beta = 0.6$)

Fig. 7. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with DeepFM and DeepFM enhanced version with LDRI. We fix $N = 1$ and $\alpha = 0.6$ to examine the recommendation differences with $\beta = 0.4, 0.5, 0.6$.



(a) NFM on Pure ($\beta = 0.4$) (b) NFM on Pure ($\beta = 0.5$) (c) NFM on Pure ($\beta = 0.6$) (d) NFM on 1K ($\beta = 0.4$) (e) NFM on 1K ($\beta = 0.5$) (f) NFM on 1K ($\beta = 0.6$)

Fig. 8. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with NFM and NFM enhanced version with LDRI. We fix $N = 1$ and $\alpha = 0.6$ to examine the recommendation differences with $\beta = 0.4, 0.5, 0.6$.



(a) AFM on Pure ($\beta = 0.4$) (b) AFM on Pure ($\beta = 0.4$) (c) AFM on Pure ($\beta = 0.4$) (d) AFM on 1K ($\beta = 0.4$) (e) AFM on 1K ($\beta = 0.4$) (f) AFM on 1K ($\beta = 0.4$)

Fig. 9. NDCG@5 results on KuaiRand-Pure (Pure) and NDCG@300 results on KuaiRand-1K (1K) at each release interval with AFM and AFM enhanced version with LDRI. We fix $N = 1$ and $\alpha = 0.6$ to examine the recommendation differences with $\beta = 0.4, 0.5, 0.6$.

3.3 Cold Start Setting

In this section, we present the experimental results for the cold start scenario. As outlined in the main text, we conducted cold start experiments exclusively on the KuaiRand-1K dataset, since the fixed item pool configuration of the KuaiRand-Pure dataset renders it unsuitable for this type of experiment. The conclusions are broadly consistent with those presented in Sections 3.1 and 3.2.

For furtuer details, please refer to Table 6 below.

Table 6. TopK recommendation results under cold start conditions assessed on the KuaiRand-1K dataset. We fix $N = 1$ and $\alpha = 0.6$, and compare the recommendation performance with different values of β ($\beta = 0.4, 0.5, 0.6$). The recommendation results of the backbones (DeepFM, NFM and AFM) are not affected by the values of the hyperparameters. Consistent with the main text, cold-start experiments are not suitable for the KuaiRand-Pure dataset because its items originate from a fixed item pool.

Dataset	Method	RECALL@300			MAP@300			NDCG@300			HR@300		
		$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$	$\beta = 0.4$	$\beta = 0.5$	$\beta = 0.6$
KuaiRand-1K	DeepFM		0.8332			0.1422			0.3343			0.9875	
	DeepFM+LDRI **(Ours)**	0.8418	0.8483	0.8363	0.1856	0.1865	0.1693	0.3755	0.3781	0.3630	0.9898	0.9886	0.9864
	DeepFM+LDRI-iter **(Ours)**	0.8408	0.8490	0.8372	0.1870	0.1877	0.1693	0.3769	0.3803	0.3633	0.9886	0.9864	0.9852
	NFM		0.7468			0.1248			0.3033			0.9739	
	NFM+LDRI **(Ours)**	0.8002	0.7972	0.7831	0.1574	0.1592	0.1484	0.3421	0.3431	0.3311	0.9875	0.9852	0.9830
	NFM+LDRI-iter **(Ours)**	0.7978	0.7944	0.7832	0.1626	0.1594	0.1518	0.3466	0.3429	0.3343	0.9830	0.9841	0.9830
	AFM		0.7784			0.1676			0.3474			0.9750	
	AFM+LDRI **(Ours)**	0.8703	0.8651	0.8624	0.2193	0.2115	0.2058	0.4050	0.3990	0.3940	0.9898	0.9875	0.9886
	AFM+LDRI-iter **(Ours)**	0.8690	0.8633	0.8605	0.2174	0.2088	0.2039	0.4037	0.3965	0.3921	0.9898	0.9886	0.9886