Non-Compensatory Psychological Models for Recommender Systems

ID: 335

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Experiments

Rating Prediction Performance

Evaluation Metrics. The goal is to reconstruct the observed user-item ratings as accurate as possible. Hence we evaluate different approaches based on the following metrics. (1) AUC: (2) NDCG (3) RMSE (4) MAE (5) MRR

Table 1: Statistics of Datasets with ratings and implicit feedback

Dataset	#users	#items	#ratings	#sessions
Movielens	942	1650	80000	4641262
FilmTrust	1235	2062	35497	623516
CiaoDVD	2665	14280	72665	2478836

Table 2: Comparative rating prediction performance

Dataset	Method	AUC	NDCG	RMSE	MAE	MRR
Movielens	MF					
	MF-NCR					
	AMF	0.6043	0.5003	1.1682	0.9924	0.7506
	AMF-NCR	0.6129	0.5027	1.4392	1.2560	0.7559
	LLORMA		0.8990	0.9291	0.7322	0.5761
	LLORMA-NCR		0.8994	0.9217	0.7288	0.5761
Filmtrust	MF					
	MF-NCR					
	AMF	0.6244	0.5055	0.8601	0.7448	0.7622
	AMF-NCR	0.6436	0.5098	1.1535	0.9330	0.7717
	LLORMA		0.8672	0.8341	0.6437	0.6481
	LLORMA-NCR		0.8684	0.8310	0.6417	0.6533
CiaoDVD	MF					
	MF-NCR					
	AMF	0.6211	0.5048	1.2025	1.0261	0.7607
	AMF-NCR	0.7993	0.5657	1.1475	0.9723	0.8950
	LLORMA		0.7827	1.0436	0.8188	0.4883
	LLORMA-NCR		0.7838	1.0608	0.8271	0.4904

Ranking Performance for Implicit Feedback

Table 3: Comparative ranking prediction performance with implicit feedback—nonono

Dataset	Method	MAP	NDCG	Prec	Recall	MRR
Movielens	BTL	0.7654	0.5070	0.5307	0.7553	0.7654
	BTL-NCR	0.8440	0.5425	0.6879	0.8340	0.8440
	BPR	0.8478	0.5443	0.6956	0.8478	0.8478
	BPR-NCR	0.8623	0.5508	0.7246	0.8623	0.8623
	FSBPR	0.7474	0.4993	0.4968	0.7583	0.7484
	FSBPR-NCR	0.7964	0.5205	0.5908	0.7856	0.7954
	LCR					
	LCR-NCR					
Filmtrust	BTL	0.7674	0.5070	0.5307	0.7551	0.7654
	BTL-NCR	0.8182	0.5312	0.6379	0.8089	0.8190
	BPR	0.7825	0.5147	0.5649	0.7825	0.7825
	BPR-NCR	0.8365	0.5392	0.6730	0.8365	0.8365
	FSBPR	0.7484	0.4996	0.4980	0.7387	0.7490
	FSBPR-NCR	0.7956	0.5205	0.5908	0.7953	0.7954
	LCR					
	LCR-NCR					
CiaoDVD	BTL	0.8009	0.5230	0.6016	0.7903	0.8008
	BTL-NCR	0.9394	0.5857	0.8787	0.9291	0.9393
	BPR	0.7241	0.4883	0.4481	0.7240	0.7240
	BPR-NCR	0.9537	0.5922	0.9074	0.9537	0.9537
	FSBPR	0.7501	0.5001	0.5004	0.7401	0.7502
	FSBPR-NCR	0.8906	0.5637	0.7815	0.8806	0.8908
	LCR					
	LCR-NCR					

Table 4: Comparative ranking prediction performance

Dataset	Method	MAP	NDCG	Precision	AUC	MRR
Movielens	BTL	0.7654	0.5070	0.5307		0.7654
	BTL-NCR	0.8440	0.5425	0.6879		0.8440
	BPR	0.8478	0.5443	0.6956	0.7002	0.8478
	BPR-NCR	0.8623	0.5508	0.7246	0.7246	0.8623
	FSBPR	0.7474	0.4993	0.4968		0.7484
	FSBPR-NCR	0.7964	0.5205	0.5908		0.7954
	LCR					
	LCR-NCR					
Filmtrust	BTL	0.7674	0.5070	0.5307		0.7654
	BTL-NCR	0.8182	0.5312	0.6379		0.8190
	BPR	0.7825	0.5147	0.5649	0.7825	0.7825
	BPR-NCR	0.8365	0.5392	0.6730	0.6728	0.8365
	FSBPR	0.7484	0.4996	0.4980		0.7490
	FSBPR-NCR	0.7956	0.5205	0.5908		0.7954
	LCR					
	LCR-NCR					
CiaoDVD	BTL	0.8009	0.5230	0.6016		0.8008
	BTL-NCR	0.9394	0.5857	0.8787		0.9393
	BPR	0.7241	0.4883	0.4481	0.6380	0.7240
	BPR-NCR	0.9537	0.5922	0.9074	0.8982	0.9537
	FSBPR	0.7501	0.5001	0.5004		0.7502
	FSBPR-NCR	0.8906	0.5637	0.7815		0.8908
	LCR					
	LCR-NCR					

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Table 5: ranking -Movielens
Table 7: ranking -Tmall

Table 5: Statistics of Datasets with graded sessional feedback

Dataset	#users	#items	#ratings	#sessions
Tmall-single	33815	176231	5682833	364844
Tmall-hybrid	62101	198344	6072061	475503
Yoochose	1	30852	3044572	341396

Table 6: Comparative ranking prediction performance with graded sessional feedback

Dataset	Method	MAP	NDCG	Prec	Recall	MRR
Tmall-single	BTL	0.4348	0.2814	0.2787	0.7253	0.4890
	BTL-NCR	0.4408	0.2853	0.2810	0.7308	0.4973
	BPR	0.4359	0.2826	0.2789	0.7252	0.4932
	BPR-NCR	0.4410	0.2854	0.2810	0.7305	0.4977
	FSBPR	0.4163	0.2732	0.2734	0.7092	0.4717
	FSBPR-NCR	0.4193	0.2747	0.2749	0.7130	0.4740
	LCR					
	LCR-NCR					
Tmall-hybrid	BTL	0.5015	0.3056	0.2934	0.7931	0.5458
	BTL-NCR	0.5592	0.3305	0.3044	0.8249	0.6063
	BPR	0.5463	0.3248	0.3006	0.8132	0.5950
	BPR-NCR	0.5635	0.3324	0.3050	0.8267	0.6112
	FSBPR	0.4398	0.2770	0.2768	0.7431	0.4817
	FSBPR-NCR	0.4597	0.2865	0.2831	0.7624	0.5007
	LCR					
	LCR-NCR					
Yoochoose	BTL	0.6368	0.4742	0.4569	0.8732	0.7156
	BTL-NCR	0.7112	0.5166	0.4786	0.8966	0.7882
	BPR	0.6821	0.5019	0.4711	0.8934	0.7639
	BPR-NCR	0.7049	0.5144	0.4775	0.9030	0.7844
	FSBPR	0.5685	0.4379	0.4374	0.8405	0.6541
	FSBPR-NCR	0.6825	0.5445	0.5362	0.8839	0.7987
	LCR					
	LCR-NCR					

Table 7: Comparative rating prediction performance

Dataset	Method	AUC	NDCG	RMSE	MAE	MRR
Movielens	MF-biased					
	MF-NCR-b					
Filmtrust	MF-biased		0.3102			
	MF-NCR-b					
CiaoDVD	MF-biased					
	MF-NCR-b					

Table 8: Scale of strength parameter θ

Method	Movielens	FilmTrust	CiaoDVD
MF-NCR	0.61 ± 0.11	0.67 ± 0.02	0.77± 0.05
AMF-NCR	1.62 ± 0.04	1.58±0.13	1.68±0.09
LLORMA-NCR			
BTL-NCR	1.57±0.22	1.60±0.34	1.37±0.32
BPR-NCR	0.05±0.0001	0.05±0.001	0.15±0.002
FSBPR-NCR	1.88±0.14	1.89±0.11	2.92±0.54
LCR-NCR			
Method	Tmall-single	Tmall-hybrid	Yoochoose
BTL-NCR	5.14±1.12	5.10±0.69	4.62±0.53
BPR-NCR	0.13±0.01	0.86±0.07	0.06±0.001
FSBPR-NCR	5.01±1.07	4.92±0.97	4.36±0.94
LCR-NCR			

Table 9: Scale of user-defined aspect-specific threshold $\mathbf{b}_{u,k}$

Method	Movielens	FilmTrust	CiaoDVD
$std(\mathbf{b}_{u,k})$			

Table 10: Comparative performance for compensatory and non-compensatory rating prediction models, 'Improve' indicates the improvements of non-compensatory versions relative to the original models.

Dataset	Method	AUC	Improve	NDCG	Improve	MRR	Improve
Movie lens	MF	0.6661		0.6856		0.8391	
	MF-N	0.6990	4.94%	0.7107	3.67%	0.8745	4.23%
	AMF	0.6043		0.5003		0.7506	
	AMF-N	0.6129	1.43%	0.5027	0.48%	0.7559	0.71%
	LLORMA	0.6453		0.8990		0.5761	
	LLORMA-N	0.6516	0.98%	0.8994	0.04%	0.5761	0.01%
Film trust	MF	0.6056		0.5240		0.7522	
	MF-N	0.6166	1.81%	0.5252	0.24%	0.7624	1.35%
	AMF	0.6244		0.5055		0.7622	
	AMF-N	0.6436	3.07%	0.5098	0.85%	0.7717	1.24%
	LLORMA	0.5336		0.8672		0.6481	
	LLORMA-N	0.5517	3.39%	0.8684	0.14%	0.6533	0.80%
Ciao DVD	MF	0.5915		0.6497		0.8427	
	MF-N	0.6948	17.45%	0.6872	5.77%	0.8969	6.43%
	AMF	0.6211		0.5048		0.7607	
	AMF-N	0.7993	28.69%	0.5657	12.05%	0.8950	17.67%
	LLORMA	0.6986		0.7827		0.4883	
	LLORMA-N	0.6998	0.17%	0.7838	0.14%	0.4904	0.43%

Table 11: Comparative performance for compensatory and non-compensatory ranking aware models, 'Improve' indicates the improvements of non-compensatory versions relative to the original models.

Dataset	Method	AUC	Improve	NDCG	Improve	MRR	Improve
Movie lens	BT	0.6021		0.5070		0.7654	
	BT-N	0.6434	6.86%	0.5425	7.02%	0.8440	10.27%
	BPR	0.7002		0.5443		0.8478	
	BPR-N	0.7246	3.48%	0.5508	1.20%	0.8623	1.71%
	FSBPR	0.5923		0.4990		0.7484	
	FSBPR-N	0.6512	9.94%	0.5205	4.26%	0.7954	6.28%
	LCR	0.6103		0.8278		0.6793	
	LCR-N	0.6212	1.79%	0.8365	1.05%	0.6862	1.02%
Film trust	BT	0.6317		0.5070		0.7654	
	BT-N	0.7269	15.07%	0.5312	4.79%	0.8190	7.00%
	BPR	0.7825		0.5147		0.7825	
	BPR-N	0.6728	−14.02%	0.5392	4.75%	0.8365	6.91%
	FSBPR	0.5970		0.4996		0.7490	
	FSBPR-N	0.7165	20.01%	0.5205	4.20%	0.7954	6.19%
	LCR	0.5207		0.9020		0.7336	
	LCR-N	0.5262	1.06%	0.9056	0.40%	0.7533	2.69%
Ciao DVD	BT	0.6136		0.5203		0.8008	
	BT-N	0.7892	28.62%	0.5857	11.99%	0.9393	17.30%
	BPR	0.6380		0.4883		0.7240	
	BPR-N	0.8982	40.78%	0.5922	21.28%	0.9537	31.71%
	FSBPR	0.6003		0.5001		0.7502	
	FSBPR-N	0.6589	9.76%	0.5637	12.72%	0.8908	18.73%
	LCR	0.6931		0.9380		0.8122	
	LCR-N	0.7001	1.01%	0.9513	1.42%	0.8248	1.55%

Table 12: Comparative performance for compensatory and non-compensatory models on ranking implicit feedback, 'Improve' indicates the improvements of non-compensatory versions relative to the original models.

Dataset	Method	AUC	Improve	NDCG	Improve	MRR	Improve	MAP	Improve	Prec	Improve
Tmall-single	BT	0.7253		0.2814		0.4890		0.4348		0.2787	
	BT-N	0.7308	0.76%	0.2853	1.36%	0.4973	1.70%	0.4408	1.38%	0.2810	0.81%
	BPR	0.7252		0.2826		0.4932		0.4359		0.2789	
	BPR-N	0.7305	0.73%	0.2854	0.99%	0.4977	0.91%	0.4410	1.17%	0.2810	0.77%
	FSBPR	0.7092		0.2732		0.4717		0.4163		0.2734	
	FSBPR-N	0.7130	0.53%	0.2747	0.57%	0.4740	0.48%	0.4193	0.72%	0.2747	0.48%
	LCR	0.		0.		0.		0.		0.	
	LCR-N	0.	%	0.	%	0.	%	0.	%	0.	%
Tmall-hybrid	BT	0.7931		0.3056		0.5458		0.5015		0.2934	
	BT-N	0.8249	4.01%	0.3305	8.15%	0.6063	11.09%	0.5592	11.50%	0.3044	3.75%
	BPR	0.8132		0.3248		0.5950		0.5463		0.3006	
	BPR-N	0.8267	1.66%	0.3324	2.33%	0.6112	2.72%	0.5635	3.15%	0.3050	1.45%
	FSBPR	0.7431		0.2770		0.4817		0.4398		0.2768	
	FSBPR-N	0.7624	2.60%	0.2865	3.44%	0.5007	3.95%	0.4597	4.53%	0.2831	2.24%
	LCR	0.		0.		0.		0.		0.	
	LCR-N	0.	%	0.	%	0.	%	0.	%	0.	%
Yooch oose	BT	0.8732		0.4742		0.7156		0.6368		0.4569	
	BT-N	0.8966	2.67%	0.5166	8.94%	0.7882	10.14%	0.7112	11.69%	0.4786	4.76%
	BPR	0.8934		0.5019		0.7639		0.6821		0.4711	
	BPR-N	0.9034	1.12%	0.5149	2.59%	0.7854	2.82%	0.7057	3.46%	0.4777	1.39%
	FSBPR	0.8405		0.4379		0.6541		0.5685		0.4374	
	FSBPR-N	0.8839	5.15%	0.5445	24.34%	0.7987	22.11%	0.6825	20.06%	0.5362	22.59%
	LCR	0.		0.		0.		0.		0.	
	LCR-N	0.	%	0.	%	0.	%	0.	%	0.	%