

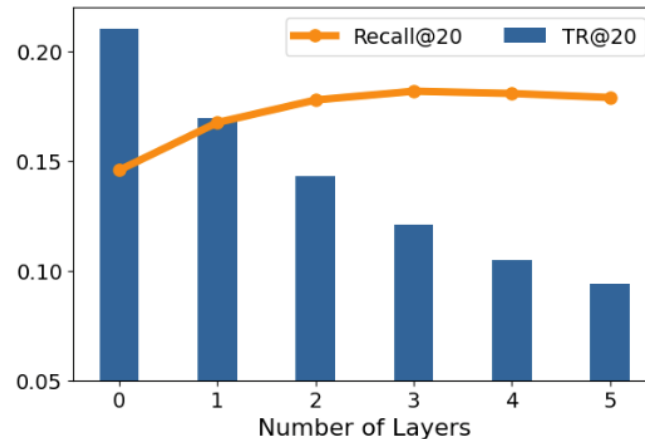
How Graph Convolutions Amplify Popularity Bias for Recommendation?

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Problems & Ideas

- Problems of GCNs in Recommendation:
 - Although improving the overall accuracy, GCNs unfortunately amplify popularity bias --- tail items are less likely to be recommended.



Performance change of LightGCN with different graph convolution layers on Gowalla. Recall@20 and TR@20 stand for the overall recall score and the ratio of tail items in the top-20 recommendation list, respectively.

- Ideas: We identify two fundamental factors that GCNs amplify popularity bias through theoretical analyses, then propose to estimate the amplified effect and intervene the effect in GCNs.

Main Contributions

- Contributions:
 - Providing in-depth theoretical analyses to interpret the popularity bias amplification problem in GCN-based recommenders;
 - Developing a new method working at each graph convolution layer in the inference stage to correct the popularity bias for GCN;
 - Conducting extensive experiments on three real datasets to demonstrate the effectiveness of our method.

Dataset	Gowalla				Yelp2018				Amazon-book			
	Overall		Tail		Overall		Tail		Overall		Tail	
	Recall	NDCG	Recall	NDCG	Recall	NDCG	Recall	NDCG	Recall	NDCG	Recall	NDCG
LightGCN	<u>0.1820</u>	<u>0.1546</u>	0.0434	0.0191	<u>0.0627</u>	<u>0.0516</u>	0.0091	0.0046	<u>0.0414</u>	<u>0.0321</u>	0.009	0.0051
BFGCN	0.1083	0.0805	0.0468	0.0245	0.0389	0.0311	0.0124	0.0076	0.0276	0.0211	0.0097	0.0059
LightGCN-IPSCN	0.1325	0.1132	0.0477	0.0213	0.0473	0.0391	0.0136	0.0077	0.0285	0.0221	0.0118	0.0069
LightGCN-CausE	0.1334	0.1137	0.0485	0.0225	0.0492	0.0405	0.0141	0.0085	0.0299	0.0230	0.0127	0.0078
LightGCN-DICE	0.1337	0.1138	0.0493	0.0241	0.0505	0.0409	0.0132	0.0073	0.0348	0.0264	0.0121	0.0074
LightGCN-MACR	0.1188	0.0928	0.0478	0.0219	0.0343	0.027	0.0233	<u>0.0126</u>	0.0269	0.0204	0.0108	0.0065
LightGCN-Tail	0.1647	0.1391	0.0628	0.0319	0.057	0.0466	0.0154	0.0095	0.0369	0.0283	0.0151	0.0094
LightGCN-BxQuAD	0.1378	0.1130	<u>0.0689</u>	0.0360	0.0545	0.0431	0.0209	0.0123	0.0389	0.0304	<u>0.0164</u>	0.0108
LightGCN-DAP-o	0.1834	0.1564	0.0538	0.0245	0.0634	0.0521	0.0137	0.0073	0.0436	0.0339	0.0134	0.0079
LightGCN-DAP-t	0.1672	0.1427	0.0708	<u>0.0354</u>	0.0562	0.0461	<u>0.0218</u>	0.0129	0.0414	0.0328	0.0166	<u>0.0102</u>
improve	0.77%	1.16%	23.96%	28.27%	1.12%	0.97%	50.55%	58.70%	4.83%	5.61%	48.89%	54.90%

Performance comparison between our method DAP and other counterparts.