HKU-TCL Joint Research Centre for Artificial Intelligence

Using Knowledge Graphs for Long-Tail Keyword Query Recommendation in Video Search

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Background & Objectives

- □ Background: Most current recommendation algorithms are based on the Heterogeneous Information Network (HIN). HIN extracts semantic and structural Information using meta-paths, which are manually specified. [VLDB11, WWW19]
- Objectives: Develop a meta-path automatic searching framework to enhance recommendation performance.



Heterogeneous Information Network (HIN)

User \rightarrow Movie \rightarrow Actor \rightarrow Movie; User \rightarrow Movie \rightarrow Director \rightarrow Movie



D Performance of Entity Alignment Models

	BootEA	mTransE	GCN-Align	RDGCN
Hit Rate @ 1	7.25	3.27	19.75	85.45
Hit Rate @ 10	13.83	6.16	34.72	90.36
Hit Rate @ 50	16.34	8.09	28.55	91.02
Hit Rate @ 100	24.30	16.21	46.61	91.37

Meta-paths

Methodology

- □ RMS: Reinforcement Learning (RL)-based Meta-path Selection Framework.
 - □ State: The encoding of current meta-path set.
 - □ Action: A relation in current HIN.
 - □ Policy: Decision model based on Multi-Layer Perceptron.
 - **Q** Reward: The performance improvement after using new meta-path set.



- □ HRec: A meta-path-based recommendation model
 - □ Apply HAN [WWW19] in recommendation tasks.
 - □ Apply Neighbor Sampling during training to prevent out of memory.



Experiments

- □ Comparison of RMS and Baselines (Random and Greedy)
 - □ Integrate RMS into existing meta-path-based recommenders (HERec, MCRec).
 - □ Results show RMS can always find better meta-paths than baseline methods.

Dataset	Model	Strategy	HR1	HR3	NDCG10
Yelp		RMS	0.0648	0.1484	0.1740
	HRec	Greedy	0.0489	0.1181	0.1449
		Random	0.0589	0.1381	0.1633
	HERec	RMS	0.0389	0.0979	0.1215
		Greedy	0.0374	0.0918	0.1166
		Random	0.0344	0.0922	0.1167
	MCRec	RMS	0.0548	0.1317	0.1540
		Greedy	0.0516	0.1234	0.1504
		Random	0.0526	0.1229	0.1451

- Comparison of RMS-HRec and existing recommendation models.
 - **RMS-HRec** outperforms all the existing methods.

Yelp			Douban Movie						
HR1	HR3	HR10	NDCG10	NDCG20	HR1	HR3	HR10	NDCG10	NDCG20
0.0648	0.1484	0.3213	0.1740	0.2095	0.0997	0.2131	0.4258	0.2400	0.2802
0.0388	0.1025	0.2592	0.1301	0.1638	0.0529	0.1421	0.3502	0.1768	0.2218
0.0514	0.1251	0.2927	0.1522	0.1872	0.0622	0.1605	0.3854	0.1974	0.2438
0.0456	0.1092	0.2630	0.1360	0.1710	0.0574	0.1495	0.3668	0.1862	0.2323
0.0572	0.1246	0.2721	0.1477	0.1791	0.0634	0.1646	0.3930	0.2015	0.2479
0.0389	0.0979	0.2381	0.1215	0.1528	0.0594	0.1613	0.3910	0.1984	0.2424
0.0548	0.1317	0.2887	0.1540	0.1876	0.0928	0.1961	0.3985	0.2236	0.2631
0.0100	0.0294	0.0868	0.0408	0.0583	0.0270	0.0603	0.1293	0.0742	0.0945
0.0415	0.1151	0.2718	0.1388	0.1733	0.0630	0.1644	0.3922	0.2009	0.2469
	HR1 0.0648 0.0388 0.0514 0.0456 0.0572 0.0389 0.0548 0.0100 0.0415	HR1HR30.06480.14840.03880.10250.05140.12510.04560.10920.05720.12460.03890.09790.05480.13170.01000.02940.04150.1151	YelpHR1HR3HR100.06480.14840.32130.03880.10250.25920.05140.12510.29270.04560.10920.26300.05720.12460.27210.03890.09790.23810.05480.13170.28870.01000.02940.08680.04150.11510.2718	YelpHR1HR3HR10NDCG100.06480.14840.32130.17400.03880.10250.25920.13010.05140.12510.29270.15220.04560.10920.26300.13600.05720.12460.27210.14770.03890.09790.23810.12150.05480.13170.28870.15400.01000.02940.08680.04080.04150.11510.27180.1388	YelpHR1HR3HR10NDCG10NDCG200.06480.14840.32130.17400.20950.03880.10250.25920.13010.16380.05140.12510.29270.15220.18720.04560.10920.26300.13600.17100.05720.12460.27210.14770.17910.03890.09790.23810.12150.15280.05480.13170.28870.15400.18760.01000.02940.08680.04080.05830.04150.11510.27180.13880.1733	YelpHR1HR3HR10NDCG10NDCG20HR10.06480.14840.32130.17400.20950.09970.03880.10250.25920.13010.16380.05290.05140.12510.29270.15220.18720.06220.04560.10920.26300.13600.17100.05740.05720.12460.27210.14770.17910.06340.03890.09790.23810.12150.15280.05940.05480.13170.28870.15400.18760.09280.01000.02940.08680.04080.05830.02700.04150.11510.27180.13880.17330.0630	YelpIHR1HR3HR10NDCG10NDCG20HR1HR30.06480.14840.32130.17400.20950.09970.21310.03880.10250.25920.13010.16380.05290.14210.05140.12510.29270.15220.18720.06220.16050.04560.10920.26300.13600.17100.05740.14950.05720.12460.27210.14770.17910.06340.16460.03890.09790.23810.12150.15280.05940.16130.05480.13170.28870.15400.18760.09280.19610.01000.02940.08680.04080.05830.02700.06030.04150.11510.27180.13880.17330.06300.1644	Yelp Douban M HR1 HR3 HR10 NDCG10 NDCG20 HR1 HR3 HR10 0.0648 0.1484 0.3213 0.1740 0.2095 0.0997 0.2131 0.4258 0.0388 0.1025 0.2592 0.1301 0.1638 0.0529 0.1421 0.3502 0.0514 0.1251 0.2927 0.1522 0.1872 0.0622 0.1605 0.3854 0.0456 0.1092 0.2630 0.1360 0.1710 0.0574 0.1495 0.3668 0.0572 0.1246 0.2721 0.1477 0.1791 0.0634 0.1646 0.3930 0.0389 0.0979 0.2381 0.1215 0.1528 0.0594 0.1613 0.3910 0.0548 0.1317 0.2887 0.1540 0.1876 0.0928 0.1961 0.3985 0.0100 0.0294 0.0868 0.0408 0.0583 0.0270 0.0603 0.1293 0.0415 0.1151 0.2718 0	Yelp NDCG10 NDCG20 HR1 HR3 HR10 NDCG10 NDCG20 HR1 HR3 HR10 NDCG10 0.0648 0.1484 0.3213 0.1740 0.2095 0.0997 0.2131 0.4258 0.2400 0.0388 0.1025 0.2592 0.1301 0.1638 0.0529 0.1421 0.3502 0.1768 0.0514 0.1251 0.2927 0.1522 0.1872 0.0622 0.1605 0.3854 0.1974 0.0456 0.1092 0.2630 0.1360 0.1710 0.0574 0.1495 0.3668 0.1862 0.0572 0.1246 0.2721 0.1477 0.1791 0.0634 0.1646 0.3930 0.2015 0.0389 0.0979 0.2381 0.1215 0.1528 0.0594 0.1613 0.3910 0.1984 0.0548 0.1317 0.2887 0.1540 0.1876 0.0928 0.1963 0.1293 0.0742 0.0415 0.1151 0.2718 0.1388

Current Work

- □ We are now constructing a HIN for movie data and using the latest HIN data cleaning methods [IJCAI'19] to obtain a qualified movie HIN.

□ Next, we will use RMS-HRec in this HIN.

References

- [WWW19] W. Xiao, J. Houye, S. Chuan, W. Bai, C. Peng, Y. P., and Y. Yanfang. Heterogeneous graph attention network. WWW, 2019.
- [VLDB11] Y. Sun, J. Han, X. Yan, P. S. Yu, and T.Wu. Pathsim: Meta path-based top-k similarity search in heterogeneous information networks. PVLDB, 2011.
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