



KPCR: Knowledge Graph Enhanced Personalized Course Recommendation

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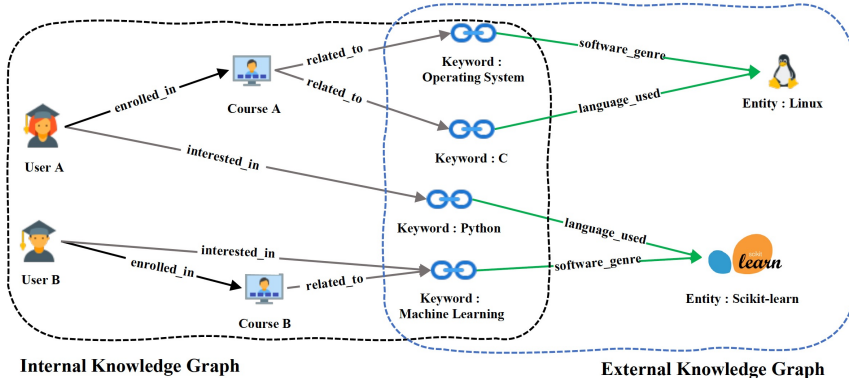
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I. Overview



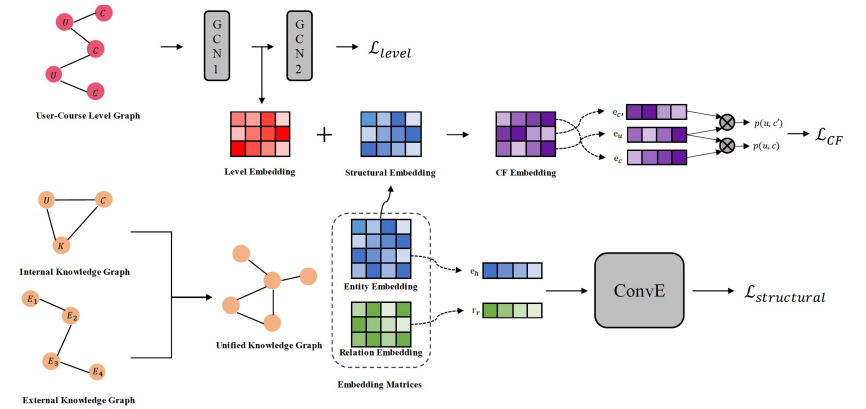
- To increase retention rate of MOOCs, recommending content appropriate to the learner's level is important.
- We propose KPCR, a course recommendation framework which leverages Knowledge Graph as side information.
- Knowledge Graph is constructed by integrating internal information of MOOCs and external knowledge base through user and course related keywords.

III. Model Performance

	ESOF				XuetangX			
	Rec@5	Rec@10	NDCG@5	NDCG@10	Rec@5	Rec@10	NDCG@5	NDCG@10
KPCR($L+S$)	0.633	0.728	0.628	0.659	0.503	0.609	0.450	0.489
KPCR(S)	0.618	0.712	0.618	0.648	0.498	0.595	0.448	0.483
KPCR(S_i)	0.612	0.701	0.610	0.639	0.495	0.589	0.447	0.481
KGAT	0.602	0.701	0.593	0.626	0.452	0.548	0.404	0.439
CKE-ConvE	0.527	0.617	0.510	0.542	0.368	0.446	0.326	0.355
CKE	0.450	0.544	0.433	0.467	0.347	0.423	0.306	0.335
BPRMF	0.589	0.676	0.583	0.611	0.435	0.518	0.394	0.424

- KPCR($L+S$) uses level embedding, structural embedding, and recommendation module.
- KPCR(S) uses structural embedding and recommendation module.
- KPCR(S_i) has same structure with KPCR(S) but trained with only internal information of MOOC (no external knowledge).

II. Model Architecture



- KPCR's Structural Embedding Module calculates the structural embedding by conducting link prediction on the knowledge graph.
- KPCR's Level Embedding Module calculates the level embedding by conducting node prediction (predict the level of users and courses) on the knowledge graph.
- KPCR's Recommendation Module calculates the matching score of the users and the courses.
- Three modules are learned by multi-task learning.

IV. User Satisfaction

	Mean		t-value	significance
	KPCR	KGAT		
personalized recommendation	4.008	3.778	2.137	0.034*
value of recommender system	4.191	3.876	3.165	0.002**

* denotes $p < 0.05$, ** denotes $p < 0.01$.

- User satisfaction was investigated through independent sample t-test.
- KPCR showed higher user satisfaction than KGAT, and the difference is statistically significant.