

論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Knowledge Graph Enhanced Review Mining for Accurate Recommendation
著者(和文)	LIUYUN
Author(English)	Yun Liu
出典(和文)	学位:博士(学術), 学位授与機関:東京工業大学, 報告番号:甲第12247号, 授与年月日:2022年9月22日, 学位の種別:課程博士, 審査員:宮崎 純,岡崎 直観,横田 治夫,金子 晴彦,下坂 正倫
Citation(English)	Degree:Doctor (Academic), Conferring organization: Tokyo Institute of Technology, Report number:甲第12247号, Conferred date:2022/9/22, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

系・コース： 情報工学 系
Department of Graduate major in 情報工学 コース
学生氏名： LIU YUN
Student's Name

申請学位 (専攻分野)： 博士 (Philosophy)
Academic Degree Requested Doctor of
指導教員 (主)： 宮崎 純
Academic Supervisor(main)
指導教員 (副)：
Academic Supervisor(sub)

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

In this study, I introduced the background and the challenges about the review-based RSs. In order to solve the existing shortcomings and challenges, I proposed three knowledge-based models: KANN, KMRR, and JPKG to mine important knowledge information from reviews for high accuracy recommendation.

Firstly, I extracted knowledge entities from reviews to address the problem of splitting meanings of phrases caused by using word embeddings to represent reviews and alleviate the sparsity and cold-start problems. For my proposed KANN, I not only considered the review entities, but also concatenated the context triples of review entities as complementary features to enrich the profiling of users/items. For KMRR and JPKG, I built a heterogeneous KG to fuse reviews and ratings and adopted a multi-task framework to implement cross feature learning between reviews and ratings to add user connections in the KG. The fusion graph structure enables the graph-link prediction task to learn the review entity features that are relevant to target users and items, which further assists my recommendation task. The increased user connections can help to better profile user preferences, thereby solving sparsity and cold-start issues.

Secondly, aiming to learn the interactions between users and items in an efficiency way, I presented inner- and outer-attention mechanisms in KANN to model the low-order interactions between users and items. The low-order interactions enable the explicit preferences of users for items to be learned and understood, and further discover and provide knowledge-level explanations. For KMRR, I employed the graph attention mechanism to capture the different neighbor contributions for users/items in the KG to exploit the effective correlations between users and items. To further improve the accuracy of recommendation and fully exploit user preferences on the graph, I used an attention-based multi-hop propagation mechanism in JPKG to take users and items as center nodes and extend their attributes along with the connections of the knowledge graph by recursively calculating the different contributions of their neighbors.

Furthermore, experimental results demonstrate that KANN achieves a better performance for rating prediction tasks and CTR tasks than state-of-the-art methods. A case study of visualization also validates its effectiveness and explainability. For KMRR and JPKG, I conduct experiments using different sparse datasets preprocessed from two real world datasets. The experimental results empirically demonstrate the effectiveness of my method, especially when the dataset is sparse. The results of ablation studies also show the effectiveness of the proposed three model designs.

As future work, I will assess the persuasiveness of explanations given by the KANN model through implementing a crowdsourcing evaluation and try to translate obtained explanations into natural language. I will also extend KANN to model auxiliary information such as temporal information. Moreover, I am interested in exploring more effective review features from multiple perspectives, such as the word and character levels. In addition, I will conduct more experiments on other datasets to evaluate the proposed models. Furthermore, I will focus on providing explainable recommendation results based on KMRR and JPKG methods by further analysing the contributions of different entity neighbors to users/movies.

Finally, I will explore other methods that can enhance the user preference mining ability on KGs.

The contributions of our proposed three models are summarized as follows.

- The proposed models can extract knowledge features from reviews and build review-based KGs while not only avoiding semantic noise but also addressing the lack of user connections.
- To the best of my knowledge, my proposed KANN is the first approach to model interactions between a user and a movie at the knowledge-level before getting their latent vectors from reviews, while selecting informative entities.
- The proposed KMRR is the first to fuse users, items, and their corresponding review entities to the same knowledge graph, and to learn the graph latent representations of users and items by using a link prediction task.
- The proposed JPKG designed a multi-task framework to jointly learn multi-hop features of user/items, which can recursively learn the different contributions of neighbors to users/items.
- I conducted experiments on two public datasets. The experimental results empirically demonstrate the effectiveness of my models, especially when the dataset is sparse. A case study of visualization also validates the explainability of my proposed KANN.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。

Attention: Thesis Summary will be published on Tokyo Tech Research Repository Website (T2R2).