KNOWLEDGE BASED RECOMMENDER SYSTEM FOR COMMUNITY QUESTION ANSWERING

Gayathry S, Harsha N, *Keerthana Kasthuril, *Varsha S, **Kiran V K

*Student, **Assistant Professor, Department of Computer Science and Engineering
N S S College of Engineering, Palakkad

Introduction

Problem Statement

As the number of questions getting posted in Community Question Answering (CQA) increases significantly, experts find it difficult to identify the questions of their interests and this indirectly reduces the participation rate. The state-of-art expert recommendation system lack the semantic aspects of questions and time to get answered. Building a knowledge graph-based recommendation system with the use of appropriate embedding and inference algorithms will be the perfect one to solve these issues.

Recommendation Systems

- Provides most appropriate expert for a given question.
- Given new question is mapped to the top k experts recommended by the system.
- Recommendation is based on the ranking of professionals which depends on number of similar questions answered by the them.

Different Recommendation systems for CQA

1. Static Model
   Models that define the topic first and perform recommendation based on the prior assumptions.
2. Dynamic Model
   Model that can include the new topics and perform recommendation based on the evolved model.

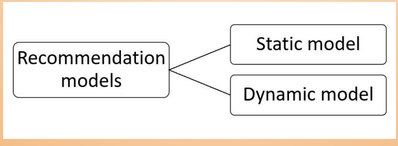

Figure 1: Classification of recommendation models

Knowledge Graph (KG)

- Knowledge Graph (KG) is a semantic network introduced by Google which can transform data into knowledge.
- The KG based recommendation process consist of two steps:
  1. Triple generation
  2. KG Embedding and Knowledge Inference
- Entity set and relation set are identified, triplets are generated from data and stored in the first step.
- Subgraph containing relevant entity and relations are extracted and inference algorithms are applied in the second step.

KG Layers

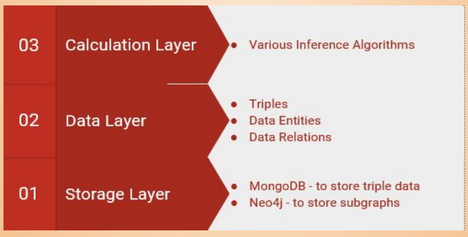

Figure 2: Layers of KG

- The KG storage layer may store data in the form of subgraphs or it may store as triplets.
- In the data layer, triplets are created which is a combination of two entities and a relation.
- In the calculation layer different algorithms which will recommend experts based on KG.

Knowledge based Question Recommendation System

System Architecture

The process of making KG based recommendation system (KBRS) is divided mainly into three layers that is shown in Figure 3. The entire process that is followed inbuilding the recommendation system is shown in Figure 4.

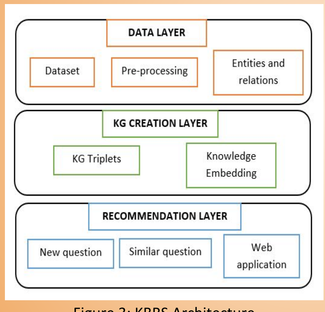

Figure 3: KBRS Architecture

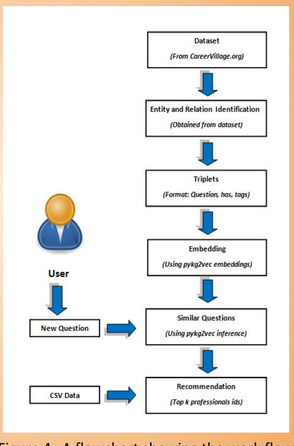

Figure 4: A flowchart showing the work flow

Implementation

- Phase 1: Triple generation (shown in Figure 5)
- Phase 2: Embedding and Obtaining similar questions using KG inference.
- Phase 3: Recommending experts based on the answers given to these similar questions.

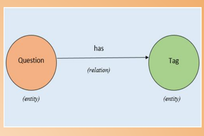

Figure 5: KG triplets

KG Creation

- KG is created from the triplets is shown in the Figure 6.

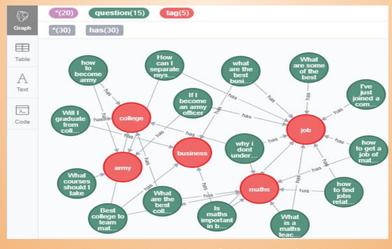

Figure 6: A portion of KG created in Neo4j

Embedding and Inference

Knowledge Graph Embedding

- KG embedding by TransH is used to obtain the entity and relation embeddings. A sample illustration of TransH is shown in Figure 7.

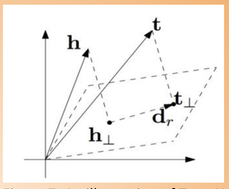

Figure 7: An illustration of TransH

Question Similarity Identification

- It checks the answer history of similar questions that were previously asked in the domain.
- Previous questions can be obtained by KG inference

Inference Results

The test results provided by the KBRS and the KG based algorithms are given in Table.1.

	KBRS	RWHR-DUSKG	UCF-DUSKG	ICF-DUSKG	CSR-DUSKG	Hybrid Model
Precision	82.4	58.38	28.18	29.76	20.59	15.03
Recall	85.5	76.18	45.44	41.98	33.34	10.45

Experiments and Results

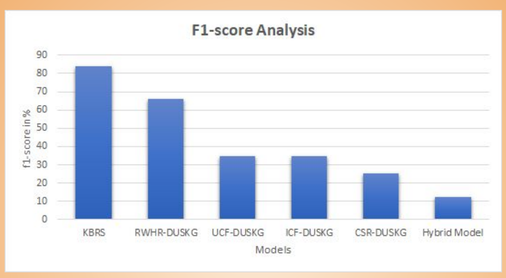

Figure 8: F1-Score

- From the results, it is evident that KBRS has better results.
- It can also be concluded that the recommendation of professionals who had answered related question is a better approach in CQA.
- The KBRS not only recommend efficiently, but also reduces the sparse data problem and incorrect data problem.
- By using such a recommendation system, the response time for CQA can be reduced.

Conclusions and Future works

- The proposed system focus on finding the top best experts who can give significant answers to the given question.
- Usage of KG inference reduces the difficulty of finding previously answered similar questions .
- Consideration of relevance of previous answers helps to choose the people who answer best.

Future Works

- Automatic recommendation of questions to appropriate experts
- The email ids of the professionals can be used to send them notifications. So they will get alert and answers the questions quickly.
- This model requires complete prevention of cold start problem.

References

[1] Haifang Wang, Zhongjie Wang, Sihang Hu, Xiaofei Xu, Shiping Chen, and Zhiying Tu, "DUSKG: A fine-grained knowledge graph for effective personalized service recommendation", Future Generation Computer Systems, vol.100, pp. 600-617 (2019).

[2] Zhen Wang, et al., "Knowledge Graph Embedding by Translating on Hyperplanes", In proceedings of the Twenty-Eighth AAAI Conference on Artificial Intelligence, 2014.

[3] Xianxian H, "Knowledge Graph (KG) for Recommendation System". May 14, 2019. Accessed on: November 1, 2019. [Online]. Available: https://medium.com/@hxianxian/knowledge-graph-kg-for-recommendation-system-8fe2c6cd354.

[4] Yu, Shih Yuan and Rokka Chhetri, Sujit and Canedo, Arquimedes and Goyal, Palash and Faruque, Mohammad Abdullah Al Faruque, "Pykg2vec: A Python Library for Knowledge Graph Embedding", arXiv preprint arXiv:1906.04239, 2019.

[5] Xu Liang, "Summary of Translate Model for Knowledge Graph Embedding". December 12, 2018. Accessed on: February 12, 2020. [Online]. Available: https://towardsdatascience.com/summary-of-translate-model-for-knowledge-graph-embedding-29042be64273.