A User Interaction Demonstration For Exploring Medical Knowledge Graph

Jin Xiao[1], Lianfen Miao[1], Chunyu Li[1], Ruimin Lu[1], Bo Chen[1], and Yuan Ni[1]

PingAn Technology, Shanghai, China

Abstract. As the importance of the knowledge graph increasing in many fields, finding an efficient way to display and interact with the data is a huge challenge, especially in the medical field. We here revealed an initial proof-of-concept demonstration, a web application. In this demonstration, we will show the user interface to explore or get information from the domain-specific real-world data. The demonstration exhibits the flexibility of displaying complex medical data, helps users to understand and explore their data. We'll have fun with a use case of the demonstration. For more information, please visit our website(`http://121.12.85.245:1316/#/`) or watch the video on YouTube(`https://www.youtube.com/watch?v=E4qw-_q5etY`).

1 Introduction

A knowledge graph represents entities and their relations. In order to help users or domain experts make intelligent decisions and support artificial intelligence systems for medical applications, such as information retrieval, Q&A and so on, we build a huge but high-quality medical knowledge graph in Chinese. Our knowledge graph covers 2.7 million medical terms, including 1 million core terms such as diseases, symptoms, drugs, body structure, examination etc. It also includes various medical relationship triples such as disease-symptoms, disease-examination, disease-indications. An entity, such as *heart failure*(心力衰竭), can be associated with many other entities especially in medical field. One example is that *heart failure* $-$ `has symptom` $\rightarrow$ *cyanosis*, as same as

$$triple(heartfailure, hassymptom, cyanosis)$$

Based on the technique shown in Fig.1, our medical knowledge graph was constructed by six subsequent steps. We is constructed a Knowledge Graph in the medical field.

1. **Data Collection**. Firstly, We obtain a lot of unstructured, semi-structured, structured data from various sources, such as OMAHA[1], UMLS[2], ICD-10[3] ,some medical websites and drug instructions.

[1] `https://www.omaha.org.cn/`
[2] `https://www.nlm.nih.gov/research/umls/`
[3] `https://www.who.int/classifications/icd/icdonlineversions/en/`

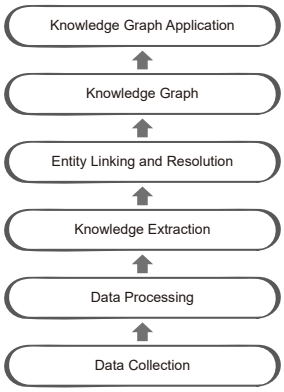

Fig. 1: The Architecture of Our Knowledge Graph

2. **Data Processing**. Cleaning data is the main task in this step.
3. **Knowledge Extraction**. Information Extraction from the data was handled by last step, include named entity recognition and relation extraction.
4. **Entity Linking and Resolution**. Based on medical data reviewed by authoritative medical experts, we integrate data from various sources,by applied for entity linking and resolution technology.
5. **Knowledge Graph Construction**. We store the graph data into the Neo4j database.
6. **Knowledge Graph Application**. This knowledge graph empowers to many applications in our product. This demonstration shows novel and efficient user interaction of medical data.

There is a lot of work focused on how to visualize knowledge graph [1,2,3]. However, a visualization tool of a knowledge graph which is universal, effective and concise rarely appears. Our demonstration is a tool what aim to make it easier to explore and visualize knowledge graph data. The demonstration system is composed by two components:

- **api backend**, which contains a graph database, supported by *Neo4j*[1]. and a *RESTful* API used for providing data to frontend interface.
- **frontend or interface**, a web interface implemented by *JavaScript* and *HTML*[2].

2 Demonstration of Use Cases

For constructing and using the knowledge graph, we used a dashboard for summarizing the data, as showed in Fig.2.

[1] `https://neo4j.com/`
[2] Chrome browser is recommended

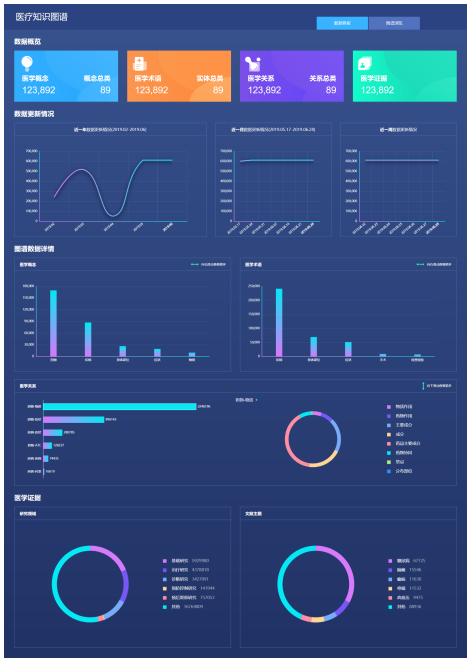

Fig. 2: The dashboard of demonstration

One the second tab, a hierarchical disease tree can be found(Fig.3), which can be folded and unfolded by click.

Fig. 3: Hierarchical disease tree

When we click on the nodes 心血管系统疾病 → 心脏病 → 心力衰竭 in order on the tree, a main view will be showed on the right of page to represent the corresponding data where the center is clicked node. Furthermore, disease, symptom and drug entities associated with it can switch to the center by clicking.

The encyclopedia about the disease which would be showed when the center node being hovered. The content page contains semi-structured information such as overview, diagnosis, treatment, follow-up and common complications.

The main innovation in our demonstration is the dynamic interaction graph displayed on the right column. It consists of many rings, with lots of small dots on it, which can be clicked when the category is disease, drug or symptom(Fig.4). Different rings represent different node categories, category of the ring can be seen in the legend under the graph. The English mapping can be found on Table 1. When clicking the rings, it will be highlighted and the related node will appear

around the center node. The bottom right corner is a track which can go back to the node that was clicked in the previous steps. For more features, please visit our website.

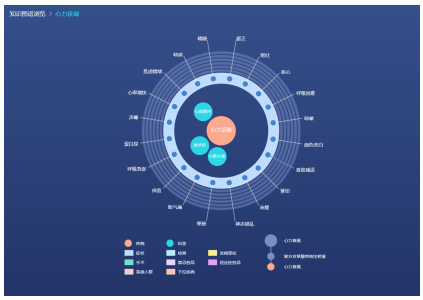

Fig. 4: Interaction snapshots of the demonstration

Table 1: The English mapping of Chinese keyword

Chinese	**English**	**Example**
疾病	disease	心力衰竭 • heart failure
症状	symptom	紫绀 • cyanosis
检查	test	放射性核素成像 • radionuclide imaging
发病部位	bodystruce where disease be found	心脏 • heart
手术	surgery	气管内插管 • endotracheal intubation
禁忌药品	constrained drugs	氨茶碱片 • aminophylline tablets
适应症药品	indication drugs	氯丙酸片 • chloropropionate tablets
易感人群	susceptible population	老年人 • elderly group
下位疾病	sub-disease of a disease	慢性心力衰竭 • chronic heart failure

3 Conclusions

Only first two disease tree can be clicked in this demonstration. However, the approach to explore and visualize the graph data is novel and effective. We proposed the interface way, showed in the demonstration, would help doctors, domain experts or the public, who are exploring and searching information from a knowledge graph. Meanwhile helping them get access to information and make informed decisions more easily.

References

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