

Research on Knowledge Graph Construction and Q&A Application of Campus Network Operation and Maintenance Service Based on Neo4j

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Abstract. The organization form of the data have a decisive impact on the value of the data, in order to play to the role of the data is bigger, use secondary figure database to store data, building the campus network operations services knowledge map, and USES the knowledge map construction question answering system application, meet the daily campus user demand of campus network operations services between teachers and students.

Keywords: Campus network operation and maintenance, knowledge graph, Neo4j, question answering system.

1. Introduction

At the beginning, knowledge graph was proposed by researchers to improve the quality of search engine results and enhance user experience. With the development of information technology, knowledge graph plays an important role in the academia and industry such as intelligent search, intelligent question and answer and recommendation system [1].

Today, a large part of the information organization of intelligent question answering system uses knowledge graph[2]. Q&a of domain knowledge graph based on data of medical care, finance, operation and maintenance and other industries has been quite common [3-7]. In the field of network operation and maintenance, some scholars have also carried out intelligent question answering based on operation and maintenance knowledge graph. Chang Bingbing, Luo Caixi et al. [8] constructed a service platform for product marketing, operation and maintenance for curtain wall enterprises and users, providing users with convenient q&a services. Bian Yifan, Zhou

Zhaoyong et al. [9] designed and realized the mobile end of network operation and maintenance robot system based on IPv6 network environment, and the system realized online intelligent question answering on the mobile end, providing technical support and theoretical basis for the application and promotion of artificial intelligence technology in IPv6 environment.

With the rapid development of modern information technology, campus network provides indispensable service support for teachers and students in teaching, office, class and life in colleges and universities nowadays [10]. Information center provides services are mostly adopt the way of visiting and telephone counseling service hall, answer questions using oral communication, specification, or maintenance personnel to the site service way, the way actually will greatly reduce the efficiency of problem solving, by relying on some basic knowledge of information is not structured text or picture information. Among the many factors influencing the value of data, the organization form of data plays a decisive role. According to the data, this paper proposes to construct the knowledge map of campus network operation and maintenance service, and explore the question and answer service of related content

2. Construction of knowledge graph of campus network operation and maintenance service

Knowledge graph is used to describe the relationship and attribute between different things, and consists of two types of units: "entity-relationship-entity" and "entity-attribute-attribute value" [11]. Key technologies of knowledge graph include knowledge extraction, knowledge representation,

knowledge fusion and knowledge reasoning [12]. The original data for knowledge graph construction can be structured relational data, semi-structured XML data, and unstructured data such as pictures and audio. The data of the knowledge graph constructed in this paper mainly include text data and unstructured image data.

2.1 Data acquisition of campus network operation and maintenance service

The data of this study provided by the changchun university of Chinese medicine campus information center, sorting through campus network connections, use and troubleshooting information, organize the campus card services facilities, services and related information, and other problems, campus counseling teachers and students of common eventually form a user's network problem between teachers and students and answer guide file as a data source. Some troubleshooting information and indicative information are illustrated with pictures, helping teachers and students to obtain the answers to questions more directly.

2.2 Information extraction and fusion of campus network operation and maintenance service

Using natural language processing technology, from access to the user's network problem between teachers and students on campus and answer guide file to extract effective campus network and campus card related entities, attributes, and the key information such as entity relationship and a structured processes, and to extract the total six types entity concept, 26 entity, twenty-four entity relationship, five types of relationship. Six entity concept types include q&a system entity classification, campus network access service entity classification, campus network fault service entity classification, campus network use method entity classification, campus card service facilities entity classification, campus card service business entity classification, campus card service business classification. The entity data contained by each entity type is shown in Table 1.

Table 1 Entity type of campus network operation and maintenance service knowledge map

Entity type	Chinese meaning	entity
QA	Q&a system big classification	Campus network, campus card
CampusNetAccess	Campus network access service classification	Access network line, network fee payment, IP acquisition, client download
CampusNetFailure	Campus network fault service classification	Client failure, network connection failure, antivirus failure, firewall failure, Other programs are occupied and the system has its own agent software
CampusNetUsage	Classification of the use of campus network	Phones, tablets, computers
CampusCardFacility	Campus card service facilities classification	Card Center, self-service ring storage machine, self-service card replenishment machine, Perfect Campus APP, Perfect campus wechat public account, perfect campus Alipay life account
CampusCardBusiness	Campus card service business classification	Password modification, recharge, electricity payment, unhook, loss report, card replacement, Account balance inquiry, consumption information inquiry, teacher certification

After information extraction, five entity relationship types are established. Including CampusNet_Access, CampusNet_Failure, CampusCard_Facility, and CampusCard_Business . Users through to the teachers and students on campus network question and answer guidelines for information extraction, construct the twenty-six entity attributes and attribute values, original document data file including words and images in two types of data, for the image data, add links to the end of the < img_start > and < img_end > tag, facilitate subsequent read the contents of the images, Some entity attributes and attribute values of the atlas are shown in Table 2 below.

Table 2 Part entity attribute table of campus network operation and maintenance service knowledge graph

entity	attribute	Attribute values
Campus network	Access to the	Campus network access services include: network fee payment, access network line, IP acquisition, Client installation. Specific steps, please further enter the keyword search view detailed analysis.
Campus network	The fault	The troubleshooting of campus network includes: network connection failure, client failure, antivirus failure, firewall failure, Other programs occupy control ports and the system has its own agent software. Enter keywords to view detailed troubleshooting information.
Campus network	use	The use of campus network includes: mobile phone, tablet, computer three devices, please further enter related devices Use keywords to retrieve specific answers.
Access network line	methods	First of all, connect the computer to the access point of the dormitory. There is one access point in each dormitory of apartment 1, Apartment 2 and International student apartment. The new apartment ABC has four access points in each dormitory
Access network line	Access point	Student users: There is one ACCESS point in each dormitory of Apartment 1, Apartment 2 and International student Apartment. There are four access points in each dormitory of new apartment ABC. There are also network port access points in teachers' offices.
Access network line	The picture	The picture of the network access point is: < img_start > http://localhost:63342/...

2.2.1 Import of campus network operation and maintenance service data

Import the processed entity node, relationship and attribute information into the graph database Neo4j. There are many ways to import data. You can load CSV data in one click, write Cypher CREATE statements to import data one by one, or use the official neo4J-import tool.

In this paper, Python language is used to Connect the Neo4j graph database through the Connect() method in py2neo library, and then operate the Neo4j graph database to create entity nodes and entity relationships. The Node() method is used to construct 26 entity information related to campus network and campus card, and set the attributes and attribute values of the entities related to campus network and campus card. Relationship() method was used to connect the campus network with the relational entity data of five Relationship types constructed in the campus card, and Graph() method was used to build a complete knowledge Graph of campus network operation and maintenance

service, so as to realize the import of Neo4j Graph database of campus network operation and maintenance service data.

2.2.2 Realization of knowledge graph of campus network operation and maintenance service

The key process to realize knowledge map includes extraction of related entities and relationships, construction of knowledge map and storage of knowledge map. After importing the related entities, relationships and attributes of the knowledge map into the Neo4j graph database, log in to the Neo4j graph database and view the constructed knowledge map of the campus network operation and maintenance service through the Cypher query statement "MATCH P=(n:QA)-(r)->() RETURN P LIMIT 200". See Figure 1.



Fig. 1 Knowledge graph of campus network operation and maintenance service

From the constructed knowledge map, it can be seen that there are 15 campus card related entities and 14 campus network related entities, and 5 different relationship types. The operation and maintenance staff of university information center can click the relevant campus network and campus card entity to extend the relevant node information according to the current demand of campus network service for teachers and students, so as to obtain the direct or indirect relationship between campus network and campus card entity. At the same time, the staff of the university information center can also query the constructed knowledge map through the traditional Cypher query statement in the Neo4j graph database, and directly access the target node to obtain relevant information.

To query the entity node data of "service facilities of campus card" as an example, enter "MATCH P =()-[R :CampusCard_Facility]->() RETURN P LIMIT 30" in the graph database of Neo4j to obtain the entity node of campus card and the six related nodes. The service facilities to get campus cards include "Card Center", "self-service ring depositing machine", "self-service card replenishment machine", "Perfect campus APP", "Perfect campus wechat public account", "Perfect campus Alipay Life Account". The target node data for the query is shown in Figure 2.

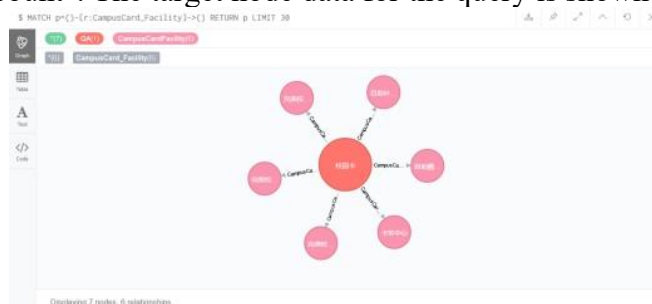


Figure 2 Example of querying related information of campus network operation and maintenance service entity

3. Research on q&A application based on knowledge graph of campus network Operation and Maintenance Service

At present, campus network operation and maintenance services in colleges and universities basically adopt hall service or telephone consultation service, which provides low satisfaction of teachers and students, and costs a lot of operation and maintenance for network center staff. Based

on the knowledge graph of campus network operation and maintenance service constructed above, it is necessary to discuss the service application of q&A system based on the knowledge graph.

3.1 Implementation method of CAMPUS network operation and maintenance service Q&A

Because there are many kinds of problems related to campus network operation and maintenance, and many problems have similarities, this paper adopts the mode of question pattern matching to achieve question answering service. The implementation of the question and answer application mainly includes three parts. Firstly, in aspect of question classification, according to the campus network knowledge map contains the campus network information construction question classification template training set and the corresponding question classification, use the TF - IDF for text feature extraction and segmentation processing of training data set and vector after word conversion, the converted TF - IDF characteristic matrix as a naive bayesian classifier of input data, After model training, the naive Bayes classifier model is obtained to realize the classification of questions. Then the part of entity recognition, which combines part-of-speech tagging and entity similarity matching. The last part is the answer a query, after question classification and entity recognition, question type, through the semantic template matching understand user questions, transforms the natural language of the user to enter into can be performed for secondary map database of Cypher query, through knowledge map of Cypher statement query campus network for the question answer after returned to the user.

3.2 Intelligent question answering system based on knowledge graph of campus network operation and maintenance service

An intelligent question answering system based on the knowledge graph of campus network operation and maintenance service is constructed using B/S architecture, which is implemented by Flask, a lightweight Web framework. The interface diagram of the question-and-answer system is shown in Figure 3, which provides question-and-answer query functions including campus network access service questions, campus network fault service questions, campus network use questions, campus card service facilities questions, and campus card service business questions.



Fig. 3 Interface diagram of intelligent question answering system based on knowledge graph of campus network operation and maintenance service

Take the campus network fault service problems and campus card service facilities problems for example to realize system functions.

3.2.1 Realize the q&A of campus network failure service

Enter the q&A platform and enter questions in the question box about campus network faults, including network connection faults, client faults, antivirus faults, firewall faults, other programs

occupying control ports, and the system's own agent software. Click Enter to output the answer to the question in the answer box. "How to solve the firewall problem? To ask questions, the interface is shown in Figure 4 below:



Figure 4 Interface diagram of campus network fault service question answering implementation example

3.2.2 Q&A of campus card service facilities

Into the q&a interactive platform, in the question box enter the campus card services class problems, related contents include: card service center, the self-service deposit machine, self-service card machine, perfect APP on campus, campus WeChat public,, perfect campus pay treasure life, such as content, click the enter key, the answer box output answers to questions. With the question "What services can a Card Center provide? The screenshot of the interface is shown in Figure 5 below:



Figure 5. Interface diagram of service facilities question answering for campus card

4. Conclusion

This paper proposes a figure database based on secondary campus network operational service knowledge map construction, introduced the construction of campus network operations services step of knowledge map, including the campus network operations service data obtaining, knowledge map information extraction and integration, knowledge map building data import and campus network operations services, and the implementation process of knowledge map. The

application research of q&A based on the knowledge graph of campus network operation and maintenance service is explored and constructed, and an example is presented according to the classification of functions. By constructing the knowledge graph, the data is organized in the form of graph, which makes the original data interpretable and deducible, and gives better play to the value of data. By constructing a question and answer system based on the knowledge graph of campus network service, this paper helps teachers and students to solve the problems of campus network service, and improves the operation and maintenance efficiency of campus network center.

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