Research on Personalized Recommendation of Magnetic Material Retrieval Based on Knowledge Mapping

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***Abstract*—Since the concept of knowledge map was introduced, the internet has gradually changed from hyperlink between web pages to describing the association between entities.Knowledge map is mainly used in personalized recommendation and other fields. It can provide users with knowledge nodes and links between nodes.In order to make personalized recommendation for each user's interests and hobbies, based on magnetic material knowledge map and collaborative filtering algorithm, this paper uses python language to mine the interests and hobbies of potential customers. through mining, summarizing, sorting and in-depth analysis of user data, combining the weight of time data and the weight of information similarity, this paper constructs the knowledge map architecture of magnetic material products, realizes the application of process and recommendation algorithm, and proposes the personalized recommendation system architecture of magnetic material retrieval based on knowledge map, which provides a technical scheme for the establishment of personalized learning resource recommendation system.**

Keywords-Magnetic Material; Knowledge Map; Personalized Recommendation

I. INTRODUCTION

With the increasing diversity of online resources, users generally use "PULL" technology to obtain online information.Although the PULL method provides users with some information, it also has some disadvantages: the customer must establish contact with the server and must know the server's address exactly.Moreover, due to frequent updates of information, users need to visit the site from time to time to obtain the latest data.PUSH technology, as a new technology on the Internet, puts forward a new service model. The service under this model has initiative and can directly push the information that users are interested in to users without them having to pick it up, thus improving the efficiency of information acquisition.Because the service has initiative, it can effectively utilize network resources and improve network throughput rate[1]. Knowledge map is made up of pieces of knowledge. Each piece of knowledge is represented as a knowledge system of entity, entity attribute and entity relationship. All data are organized into a map[2]. Its basic idea comes from semantic network, a form of knowledge representation put forward in 1950s and 1960s.The introduction of knowledge maps in the field of learning resource retrieval can organize all knowledge points in the professional field into a professional knowledge map, each node in the map represents a knowledge unit, and the logical relationships among the knowledge units are pointed out through directed edges between the units. Such knowledge maps have the characteristics of clear knowledge structure, prediction of knowledge frontiers, and disclosure of knowledge relationships[3]. Knowledge map-based search engines have begun to have more accurate semantic analysis capabilities, which can clearly identify natural language problems

In this paper, a magnetic material product recommendation system based on knowledge map is constructed by using collaborative filtering algorithm and combining knowledge map theory and related technologies on the basis of user's time and space information.The collaborative filtering recommendation system uses an algorithm to find user preference characteristics through mining user behavior data, divides users into groups based on different preferences, and recommends resource lists with similar user group preferences to users[4]. The main idea of the recommendation system design is that when the user browses the web page, the "guess you like" module of the magnetic alloy product recommendation list will pop up on the right side of the web page.Personalized recommendation based on collaborative filtering algorithm is to mine user data in the background through data mining, summarize, organize and analyze in depth, so as to make recommendations according to the interests and hobbies of each user.

II. PUSH TECHNOLOGY AND ALGORITHM

This paper is to design a recommendation system based on web. Java and Python are selected as the main development languages of the system.To increase the user interaction function based on Web to meet the needs of socialized communication and personalized knowledge submission among users and to enrich knowledge resources;Based on the framework of search, reasoning and emotion calculation, machine thinking and emotion[5] are endowed, so that it can understand semantics more intelligently and meet the entertainment needs of users such as communication, sharing and interaction.The recommendation system mainly includes two parts: personalized product recommendation and dynamic display of magnetic alloy knowledge map.Personalized magnetic alloy recommendation uses big data to mine users' browsing

information and collection information in the background, and combines with magnetic material knowledge map to push products through collaborative filtering algorithm.The dynamic display of knowledge map visually presents the relationship between entities and concepts for users, reducing the amount of operation and the tedium of reading for consumers.

The following languages and tools are used in the personalized recommendation system of magnetic alloy based on knowledge map:

A. *Python Language*

Python, as an inheritance of ABC language, is an object-oriented and powerful explanatory computer programming language invented by Guido van Rossum in 1989.Python has a history of 20 years so far. It is currently the most common programming language close to natural language. With high-level database, simple syntax and dynamic analysis, Python is an ideal scripting language in most fields.Python linked databases connect and operate MongDB databases through the DB-API interface pymssql. A sample code is given below:

```
from pymongo import MongoClient
conn =MongoClient('192.168.0.113',27017)
 db=conn.mydb
 my_set=db.test_set
users=[{"name":"zhangsan","age":18},{"name":"lisi","
age":20}]
my_set.insert(users)
    for i in my_set.find():
    print(i)
    my_set.update(
        <query>,
        <update>,
        {
                upsert: <boolean>,
                multi: <boolean>,
                writeConcern: <document>
            }
    )
```

B. *Collaborative Filtering Algorithm*

Since the system was established by people using collaborative filtering recommendation technology, collaborative filtering recommendation technology has been widely used in various recommendation systems and has become one of the most successful recommendation technologies[6]. The traditional filtering algorithm has no time dimension and has the disadvantage of not reflecting the changes of users' preferences in time. However, the collaborative filtering algorithm organically combines the time-based data weight and the information similarity-based weight to form personalized recommendation based on potential users[7]. The collaborative filtering algorithm mainly measures and scores the user behavior data, confirms the user's preference according to the scored data, searches a group of similar user group sets at the same time, and then finds out the resources in the set with high user group preference but not yet involved by the target user to recommend to the target user[8].

The implementation of the collaborative filtering algorithm in the magnetic alloy recommendation system based on the product is shown as follows: data input, algorithm calculation and data output (as shown in fig.1).

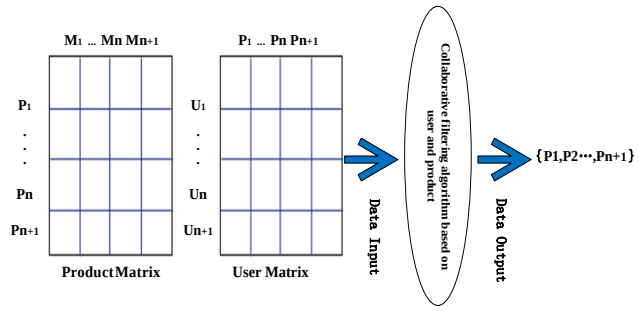

Figure 1. Collaborative filtering algorithm model

As shown in the above figure, the input data consists of a product matrix and a user matrix. The product matrix is derived from a product information table. For example, P1 represents a soft magnetic alloy with medium magnetic permeability higher than saturated medium magnetic induction strength, M1 represents a soft magnetic alloy with high saturated magnetic induction and high magnetic permeability, and is used for iron cores, pole shoes, earphone diaphragms, relay parts for earth leakage shorting devices, gas safety valves, magnetic shields, gyroscopes, automatic synchronous motors, electronic watch micromotors and the like of various transformers, relays, electromagnetic clutches, chokes and magnetic circuit parts.The user matrix is a user information table mined through Python, for example, U1 indicates: Zhang San, P1 indicates: magnetic materials purchased or browsed by Zhang San (soft magnetic alloy with medium permeability and saturated medium magnetic induction strength).The similarity between users and products is shown by formula (1) and calculated by cosine theorem:

$$YSim(i,j)=\cos\left(C_i,C_j\right)=\frac{C_i\cdot C_j}{\|C_i\|\cdot\|C_j\|}=\frac{\left(Ex_i,En_i,He_i\right)}{\left(Ex_j,En_j,He_j\right)} \quad (1)$$

Where C_i is the cloud vector of user i, using C_i =

$$Ex=\frac{1}{N}\sum_{i=1}^{N}x_i \quad (2)$$

$$He=\sqrt{\frac{\pi}{2}}\times\frac{1}{N}\sum_{i=1}^{N}\left|x_i-Ex\right| \quad (3)$$

$$En=\sqrt{s^2-\frac{1}{3}He} \quad (4)$$

$$S^2 = \frac{1}{N-1}\sum_{i=1}^{N}\left(x_i - \overline{X}\right)^2 \tag{5}$$

III. THE OVERALL FRAME DESIGN OF THE PUSH SYSTEM

The essence of the recommendation system is to find the resources that users are interested in from the mass of information and generate personalized recommendation results to provide users with differentiated search services for personalized recommendation of magnetic alloy[7].The system is mainly divided into three modules: product push module, product display module and user information base module.The recommendation system matches the information in the user matrix with the information in the product matrix, and then filters out the matching values greater than 0.6 through the calculation of the similarity of user products, finds the recommendation objects that potential users may like, and presents them to users on the web page in the form of product sets.

The personalized product push module is automatically displayed on the "guess you like module" on the right side of browsing. when users browse and purchase magnetic alloy on the web page, the server will automatically generate a session to save the current web page information. Python uses its fast and simple big data background mining technology to calculate according to the similarity of entity words in the knowledge map, find out the session currently saving the relevant magnetic alloy and obtain the IP of the current PC, and finally push the relevant magnetic alloy commodity information.

The product display module is built on the product push module. when the "guess you like" module pops up on the right side of the tour device, when the user sees the product that he is interested in, clicking will enter the product display module of the magnetic product selected by the user.The commodity display module includes not only the magnetic material knowledge card based on knowledge map, but also a series of complete knowledge applications for visualization of this alloy material.

The user information module includes Python automatic acquisition and user automatic input on the page.The product display module includes a member information registration module. If users are willing to accept more magnetic alloy materials for this tour and more information can be registered, we can improve the user information table through user registration.The information in the registry is the information provided to the system voluntarily by the user, and also includes the keywords entered by the user in the search engine.If the user does not register Python, the user information will be automatically filled in in the background and the IP and other information of the user PC will be obtained, which can better prepare for the next push.Python background mining information is user feedback information, including user preferences for recommended product sets, etc.

IV. INTELLIGENT PUSH

The recommendation system integrates domain knowledge maps (endows project entities with attributes, supports semantic analysis (insight into project essence and potential attributes), industry rules, knowledge mining and logical reasoning (complements project-to-project relationships and represents them as graph models from the perspective of inter-entity association and hierarchy), and realizes accurate and intelligent recommendation through traditional recommendation mechanisms and algorithms[9].Personalized recommendation establishes a secondary relationship between users and products. Existing Python and collaborative filtering algorithms are used to mine potential interesting objects for each user, thus personalized recommendation is made.Personalized recommendation has well solved the information overload phenomenon in the era of big data and has become the most effective tool to solve the information problem[10].Product push module (as shown in fig. 2): this module mainly displays four products frequently browsed by computer users of this machine, including high-precision multifunctional magnetic Erez aluminum alloy level gauge, new dream door curtain adsorbed by magnetic film, car mobile phone bracket capable of magnetically adsorbing and navigating by winning officials, and Deli 50803 key management box.Push product set is a dynamic model established according to users' long-term interest preferences, which will change with users' interests and needs as well as time and situation.The user's browsing behavior and content reflect the user's interests and needs. The session dialogue on the server side can save the user's browsing times, stay time, etc.

Guess what you like:

Figure 2. Magnetic Alloy Product Pushing Module

Users enter the knowledge map display module of the product when clicking on the product in the personalized recommended product set according to their interests and hobbies.Click "New Dream Magnetic Curtain" to enter the magnetic film product display module (as shown in Figure

3).This module includes three parts: the introduction of New DreamMagnetic Curtain products, the knowledge map based on magnetic films and the knowledge card of magnetic films.The difference between this system and other recommendation systems is that users can not only jump when clicking on the desired product, but also browse and purchase the product, and visually display the product in multiple dimensions by using the knowledge map. Users can understand various aspects of knowledge of magnetic films and hot spots of magnetic film research in recent years from multiple angles.Knowledge card is a high generalization of knowledge map. Through knowledge card, we can quickly understand the organization structure, preparation method and material organization structure of magnetic thin films.

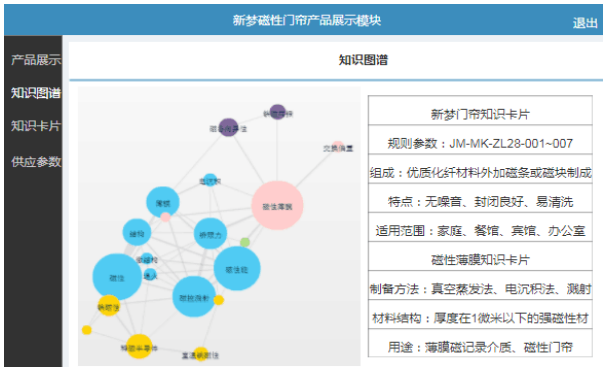

Figure 3. Product Display Module

After the user browses the product, the user information can be registered so that the system can push more useful information (as shown in fig. 4).The core of personalized information service is to understand the user information, take the user as the center, listen to the user's needs, and transfer the enterprise marketing from product-centered to user-centered through personalized recommendation.The premise of personalized recommendation is to monitor the user's behavior. Without the user's explicit participation, the system uses Python technology to dig out the user's potential interest through the length of the user's page stay and the pages visited.

Figure 4. User Information List

V. SUMMARY

The purpose of this paper is to study the application and development method of recommendation technology combined with knowledge map in the personalized recommendation process of magnetic material products. The research work is carried out from two aspects of theory and technology. The work focuses on the construction of knowledge map of magnetic material products and the design, implementation process and application of recommendation algorithm of insurance product recommendation system.Based on the knowledge map of magnetic materials and collaborative filtering algorithm, python language is used to mine the interests and hobbies of potential customers, and the time data weight and the information similarity weight are combined to realize the personalized recommendation of the guess you like module.

REFERENCES

[1] Wang Yong. Information Acquisition Method Based on Push Technology and Its Application [J]. journal of the china society for scientific and technical information, 2000, 19(4).

[2] Wu Qianqiang, Chen Haopeng, Zhao Zi Hao, et al. Learning Path Recommendation Based on MOOC Platform Data and Knowledge Map-Taking Software Engineering Major as an Example [J]. Industry and Information Education, 2017(11).

[3] Nie Jing. Python's Application Advantages in Big Data Mining and Analysis [J]. Journal of Guangxi University for Nationalities (Natural Science Edition), Journal of Guangxi University for Nationalities (Natural Science Edition), 2018.

[4] Wang Yonggu, Qiu Feiyue, Zhao Jianlong, et al. Study on Personalized Recommendation of Learning Resources Based on Collaborative Filtering Technology [J]. distance education journal, 2011,29(03).

[5] Liu Liu. Industrial Application and Future Development of Knowledge Mapping [J]. Internet Economy, 2018(4).

[6] Zhang Xuesheng. Research on Collaborative Filtering Recommendation Algorithm for Sparse Data [D]. Hefei: China University of Science and Technology, 2011.

[7] Huang Huasheng. Research on Personalized Learning Resources Recommendation Based on Knowledge Mapping [J]. Software Engineering, 2018,21(10).

[8] Zhao Jianan. Research on the Recommendation Method of Curriculum Digital Resources Based on Knowledge Mapping [D]. Beijing: Beijing University of Posts and Telecommunications, 2015.

[9] Ding Qiang. Research on Exercise Recommendation Algorithm Based on Learning Path Map [D]. Northwestern University, 2016.

[10] Sun Yusheng. Large-scale Knowledge Mapping and Its Application [J]. Information Theory and Practice. 2018(11).