Research on Information Reference Service System Based on AI

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Abstract. In the era of artificial intelligence, the library information service changes the traditional mode, and the upgrade of the new intelligent intelligence system based on artificial intelligence is an important research direction. This paper proposes a deep recommendation information recommendation service solution based on convolutional neural network, analyzes the key technologies and solutions of artificial intelligence-based information services, and explores ways to use big data to innovate library knowledge services.

1. Introduction
In 2003, the Finnish scholar Aittola M proposed the concept of “smart library”, which immediately became a research hotspot in the library. In recent years, with the breakthrough of artificial intelligence related technologies, especially the rapid development of big data, cloud computing, Internet of Things, neural networks and other technologies. Artificial intelligence has achieved unprecedented breakthroughs in the fields of semantic recognition, knowledge representation, and machine vision. New services such as artificial intelligence-based reference services have also been promoted in the field of library research. Artificial intelligence to achieve the same services as people requires industry big data support, requires strong computing power, and requires fast network transmission rates. At present, these basic support conditions are basically mature, for example: the arrival of the 5G era. CPU processing capabilities, especially the improvement of parallel processing capabilities, storage and analysis capabilities, make the full release of artificial intelligence potential, and vigorously promote the intelligent construction of various industries.

Although the concept of smart library has been proposed for a long time, it is only a matter of recent years to introduce artificial intelligence for library service research. The library uses artificial intelligence technology and power to mine the massive information resources of the library, so that artificial intelligence can understand the needs of users. The realization of proactive knowledge consulting services is also possible.

2. Principle of artificial intelligence information consultation system
With the breakthrough of artificial intelligence related technology, the library has gradually begun to explore intelligent consulting services based on deep learning. Different from the traditional traditional consulting methods based on knowledge database retrieval, the artificial intelligence consulting model based on deep learning includes artificial techniques such as speech recognition, semantic understanding, deep learning and speech synthesis. It can actively collect and mine massive collection data related to problems and massive data of massive reader behavior.
The service framework of artificial intelligence information consultation is shown in Figure 1:

![Diagram of service framework](image)

Figure 1. The service framework of artificial intelligence information consultation

The artificial intelligence information consultation system firstly transmits massive collection data, reader behavior data and interaction data to the cloud storage. Through the sorting of these big data, artificial intelligence is used to understand the reader's text and voice instructions, according to the historical log. And experience training to accurately judge the information that the reader needs, and compare and sort the relevant massive information, and feedback the most accurate results that artificial intelligence considers to the reader. Through the above series of processes, the reader feels the same experience as people in information consultation.

3. The key technology is based on intelligent information systems consulting depth of learning

3.1. Neural Network Learning and Training Model

Learning neural network model to simulate the human brain's neural network, the neural network layer node are generally more than five layers, and even up to more than 10 layers. The neural network learning model first allows each layer to learn the knowledge features from the data source in advance, and then conduct the reasoning through the neural network learning layer, so that a series of knowledge laws not found beforehand can be generated. The learning of neural network usually starts from the shallow level and gradually goes deep into the advanced features of the deep level. The output data obtained by the upper layer is used as the input data of the next layer, and finally the initial sample data is converted from the original feature space. For a new feature space, establish a joint distribution between the input problem and the output response, so as to achieve the purpose of feature learning for large-scale data. This neural network-based learning model will be more adaptable to the consultation of new and old readers after being improved by adding expert experience and correctors. As shown in Figure 2:
The acquisition of learning ability of information-based information system based on artificial intelligence is similar to the cultivation of human beings. Firstly, it needs to process data based on small corpus classifier, and gradually develop a model with higher precision, and then use it as data processed by massive data processor. The reader's behavioral information, the interaction information between the consultant librarian and the reader are all important sources of training.

3.2. Natural language understanding and processing
The system uses Google's open source toolkit word Embeddings for natural language conversion and processing. Word Embeddings converts natural language into a computer-readable Dense Vector for efficient acquisition of linguistic word vectors. In order to further understand the understanding of natural language, it is necessary to use some platform framework for deep learning. For example: CNTK, TensorFlow, Caffe, etc. In particular, the TensorFlow platform released by Google Inc. supports popular development languages such as Python and C++, and can realize networked distributed learning. The word 2vec function can be used to achieve good application effects on natural language.

Through the cloud computing platform, information that meets the needs can be pushed to readers, which can be roughly divided into three steps: preprocessing, vectorization of text and service matching. Step 1: in the pretreatment step, a large number of irrelevant noises in the original expectation should be removed. Then, the sentence is further decomposed into independent words using Chinese word splitter technology. Finally, remove distracting words from participles, such as ba, ah, etc. Step 2: text vectorization: use the Chinese version of word2vec provided by NLPchina to judge the similarity between words by the cosine value of the word vector. Step 3: in the service matching, based on the Word vector of step 2, measure the spatial Distance of Word Mover's Distance. The small spatial Distance indicates the high matching ability. Based on the above processing stage, a word2vec based reference service matching flow chart is designed, as shown in the figure3:

Figure 2. Neural network information reference service model
3.3 Convolutional Neural Network information push technology
In recent years, various deep learning neural networks have emerged, such as: Recurrent Neural Network, Long Short Term Memory, and Convolutional Neural Network. Among them, the Convolutional Neural Network is a mature and widely used feedforward neural network. Its structure is closer to that of the biological neural network, in which the neurons can respond to a certain coverage unit, especially in the large-scale information knowledge classification mode. The recognition has very good actual performance. For the library information reference service, the deep excavation of the reader's behavior, filtering the information that does not match the reader's interest, and correlating the problems with similar subject attributes, forming a user portrait for the reader, and a dialogue with a topic of high concern. Maps to generate matching personalized information reference services.

3.4 Text classification method Based on case-based Reasoning
Case-based Reasoning was first proposed by professor r. schank, which is simply a strategy that obtains original examples in historical records Based on the prompts of target examples and guides the solution of target examples by the original examples. With the characteristics of easy knowledge
acquisition, image thinking simulation and high solving rate, case-based Reasoning can overcome the problems such as the difficulty of machine learning and the low efficiency of knowledge information extraction.\(^5\)

However, the traditional case-based Reasoning text classification system has too large memory overhead, and a large amount of redundant information will appear in the face of massive library information. This system adopts hierarchical and progressive structure and method to improve the execution efficiency of the system. When a new text example retrieves an approximate example or predicts a category, it only needs to scan the three-dimensional space model, preliminarily locate the spatial coordinates, and then further search the corresponding sub-text library, which greatly saves the memory overhead and prompts the retrieval efficiency at the geometric level.

4. How the Library to achieve artificial intelligence-based information service

In the traditional library information service, the communication data between the librarian and the reader contains a lot of valuable interactive information (text, picture, audio, video, etc.). How to automatically obtain real-time value information in these seemingly irregular big data through artificial intelligence is the key to realize artificial intelligence information service.

Library consulting librarians and readers exchange big data, artificial intelligence algorithms and user behavior big data in an orderly way, and finally realize knowledge recycling and real-time information consulting services. As shown in Figure 4:

![Information service model of artificial intelligence](image)

Through the online robot to automatically capture the exchange information of the consulting librarian and the reader in real time, the reader's various behaviors are also collected, such as: click, visit duration, sharing behavior, forwarding behavior, comments, motion trajectories, and the like. The system cleans, filters, mines and analyzes these big data information.\(^6\) Through the artificial intelligence semantics to understand user questions, analyze the user's reading interest through big data corners and clusters, and finally improve a user interest map, and finally select the interactive information through the user's interest picture, and then push the most likely matching information to
the reader. The whole service process is based on big data and artificial intelligence is the core, providing readers with personalized, efficient and accurate information reference services.

In the artificial intelligence-based information service, the system administrator needs to establish a model of knowledge question and answer in advance, and continue to carry out supervised model training. When the model reaches a certain degree of stability, it can be put into practical use, and the system is actually and user. Unsupervised self-deep learning continues in the communication, and the push accuracy of predicting user demand information is continuously improved. In the new service model, experienced consulting librarians do not need to directly serve the readers, but only need to conduct random inspections of artificial intelligence consulting services, correct system errors in time, and ensure the content is safe and reliable.

5. Conclusion and outlook
In the context of the current library's vigorous promotion of the construction of smart libraries, artificial intelligence in library information services is conducive to reducing the cost of library human resources, while reducing the number of reference consultants, and improving the library service level. This provides a good starting point for the development and transformation of the library, the future of artificial intelligence application services in the library will be more extensive.

Of course, the application of artificial intelligence in library information consulting services is just getting started. In practical applications, problems such as cold start and information squatting need to be further improved in future research. At the same time, the application of artificial intelligence is gradually advanced to all aspects of library work.

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