Design and Implementation of AI Intelligent Hospital Guidance System Based on Large Language Model - A Case Study of Henan Children's Hospital

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Abstract In large general hospitals, the specialized diagnosis and treatment mode provides patients with more professional medical services, but it also brings the trouble of registration and consultation. In the face of complex diseases and numerous departments, patients often feel confused and anxious, which not only consumes a lot of time, but also may increase the risk of cross-infection. Although the traditional guidance service desk can solve this problem to a certain extent, it is difficult to meet the needs of each patient due to the limited number of guidance personnel and high work pressure. Therefore, it is particularly important to design and implement an AI intelligent guidance system. This paper will take Henan Children's Hospital as an example to introduce in detail the requirement background, knowledge base construction process, system construction and functional details of the AI intelligent guidance system based on Large Language Model, in order to provide useful reference for improving the quality and efficiency of medical services.

Keywords Hospital intelligent Guidance system; Design and implementation; AI

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Introduction

In large general hospitals, the specialized diagnosis and treatment model does make medical services more professional, but it also brings some troubles to patients. When you face a complex disease, looking at the dazzling array of departments in the hospital, you may feel a little confused and unsure of where to register. Especially in the peak period of medical treatment, the hall is flooded with people, and waiting in line has become the norm. Not only does this cost patients valuable time, but it can also increase the risk of cross-infection and compromise the medical experience. Although some hospitals have set up guidance desks to solve this problem, the results are not satisfactory. The number of guidance staff is limited, and their work is very stressful, and it is difficult to meet the needs of each patient. In many cases, patients still need to go to the department again to wait in line after receiving the initial guidance of the guide, which undoubtedly increases the complexity and waiting time for medical treatment. This phenomenon of queuing and secondary queuing not only makes patients feel anxious and dissatisfied, but also may increase the tension in the doctor-patient relationship. The long waiting time makes the patients irritable, and the guidance staff is difficult to maintain the best service attitude under the high intensity work pressure. In this vicious circle, the risk of conflict between doctors and patients also increases.

In order to solve this problem, this paper takes Henan Children's Hospital as an example, based on the content and design of the Large Language Model, it is very important to complete a set of artificial intelligence guidance system. This system can use artificial intelligence technology to make a preliminary assessment of a patient's condition and recommend a suitable department for registration. Patients simply enter their symptoms and medical history information, the system can quickly give registration recommendations. This not only greatly reduces the patient's waiting time and window operation, but also improves the convenience and accuracy of medical treatment. The AI intelligent guidance system can also update the hospital's department information and doctor scheduling in real time. In this way, patients can obtain the most accurate registration information in a timely manner and avoid delaying medical treatment because of inaccurate information. Through the application of AI intelligent guidance system, we can effectively alleviate the phenomenon of "three long and one short" in hospitals, that is, the problem of long registration time, long waiting time, long time to get medicine, and short time to see a doctor. This not only improves the patient's medical experience, but also improves the service efficiency of the hospital and makes the doctor-patient relationship more harmonious.

Knowledge base construction

The importance of knowledge base is like a cornerstone in building an efficient and accurate AI intelligent guidance system. This knowledge base must be comprehensive and detailed to cover all kinds of disease sites, symptom descriptions, corresponding disease names, as well as outpatient diagnosis and treatment departments, special outpatient introduction, doctor professional background introduction and other detailed information.

In order to ensure the authority and practicality of the knowledge base, a series of rigorous and scientific construction steps need to be taken. First of all, a large amount of data should be selected from the information system of the hospital, and carefully refined and organized, the goal is very clear, that is, only those closely related to the common diseases of the outpatient data. The data included information about where the patients had the disease, the main symptoms they described, the doctor's diagnosis, and the recommended treatment

unit. Through this series of data processing, we can initially build a structured knowledge base framework. However, relying only on these data is far from enough. In order to ensure the accuracy of the knowledge base, it is necessary to invite a number of experts in the medical field to conduct manual review and correction, so that these experts can carefully review every piece of information in the data by virtue of their rich professional knowledge and clinical experience, and correct the errors in the data. The information is updated and refined according to the latest medical research results and clinical practice.

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After the knowledge base is built, it is also equipped with a professional administrator team. These administrators are responsible for monitoring and maintaining the accuracy and integrity of the knowledge base. According to the update of medical knowledge and the development of clinical practice, they will timely add, delete and modify the disease site list, symptom list, disease list and department list in the knowledge base. Through this continuous maintenance and update, we can ensure that the knowledge base always remains scientific and accurate, and provide reliable data support for the AI intelligent guidance system. In addition, in the AI intelligent guidance system, the friendly operation interface is an important part of the user experience. Users only need to select their gender, age, disease site and related symptoms, and the system can quickly analyze and display the diseases and related diagnosis and treatment departments that users may suffer from according to the information in the knowledge base. In order to facilitate the actual use of the user, the system will be arranged in descending order of similarity, giving a list of the first several diseases. In this way, users can quickly find the most suitable diseases and departments, greatly improving the efficiency of medical treatment.

Construction of Large Language Model system and detailed explanation of functions

In today's medical field, with the rapid development of science and technology, intelligent and information-based medical service system has gradually become the key to improve the quality and efficiency of medical service. In this context, we design and implement a comprehensive medical assistance system that integrates AI intelligent diagnosis and knowledge base management. The system not only provides convenient guidance service for users, but also provides powerful knowledge base management tools for system administrators to ensure the accuracy and real-time data.

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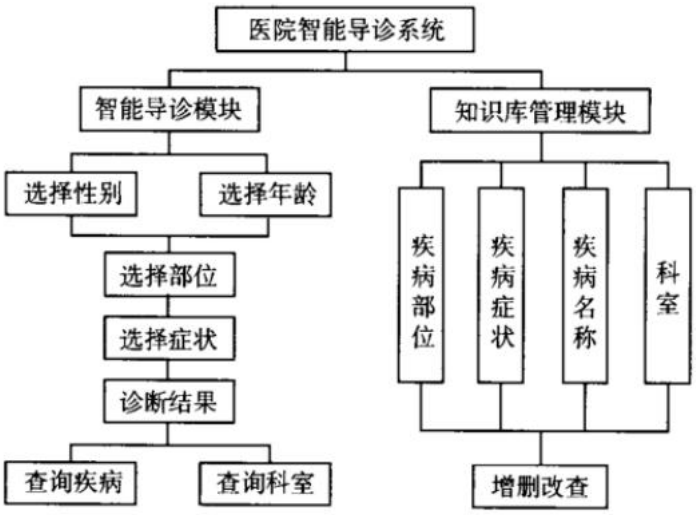
This system (Figure 1) is mainly composed of two core parts: AI intelligent diagnosis and knowledge base management. These two parts depend on each other and together constitute the complete functional system of the system. The AI intelligent diagnosis module is oriented to the majority of patients, providing an intuitive and easy-to-use interface to help users quickly locate their own conditions and find the right diagnosis and treatment department; The knowledge base management module is oriented to system administrators and provides powerful data maintenance functions to ensure the accuracy and integrity of the knowledge base.



图一：系统总体框架

AI intelligent guidance module

AI intelligent guidance module takes the user as the center, and first guides the user to input basic information through a concise and clear interface. Users select their gender and age so that the system can make a preliminary classification based on this information. This step not only helps narrow the search, but also improves the accuracy of subsequent recommendations. After determining the general condition category, the system guides the user to select specific disease sites and symptoms. According to their actual situation, users can choose the most suitable parts and symptoms from the preset options. These options are categorized and set based on expertise in the medical field, ensuring that users can find accurate information. After the user selects the disease site and symptoms, the system generates a symptom vector based on the user's input. This vector is a digital representation of the user's condition, containing all the symptom information that the user has selected. Through the generation of symptom vector, the system can more accurately understand the needs of the user's disease. Next, the system compares the user-generated symptom vector with the disease symptom matrix stored in the knowledge base. Here, the Jakard similarity algorithm is used to calculate the similarity between user symptoms and disease symptoms. Jacquard similarity is a set based similarity measure, which can effectively measure the degree of similarity between two sets. By calculating the Jakard similarity between the user's symptom vector and the disease symptom matrix, the system is able to identify the disease that most closely resembles the user's condition. After the Jakard similarity is calculated, the system ranks the diseases by how similar they are. Usually, we choose the top three diseases with the highest similarity as the final recommendation. This can not only ensure the accuracy of recommendations, but also

provide users with a variety of choices. In addition to disease recommendations, the system also supports users to query information about related diseases and diagnosis and treatment departments. Users can query relevant medical knowledge, diagnosis and treatment methods, and recommended diagnosis and treatment departments by entering disease names or keywords. All the information comes from the authoritative data in the knowledge base, which can provide valuable reference for users.

Knowledge base management module

The knowledge base management module provides powerful data maintenance function for system administrators. Administrators can add, delete and modify disease sites, disease symptoms, corresponding names and diagnosis and treatment departments according to the update of knowledge in the medical field and the development of clinical practice. These operations include not only the modification and improvement of existing data, but also the addition and import of new data. Through careful maintenance by the administrator, the knowledge base can always maintain its accuracy and integrity.

In order to ensure the accuracy and reliability of the data in the knowledge base, the system also sets up a strict data verification mechanism. When the administrator performs data maintenance, the system automatically checks and compares the input data. If data is incorrect or inconsistent, the system prompts the administrator to modify or confirm the error. This verification mechanism can minimize data errors and omissions and ensure the quality and availability of the knowledge base. In order to prevent data loss or damage caused by unexpected circumstances, the system also provides data backup and recovery functions. Administrators can periodically back up the knowledge base to save the current data status to a secure storage medium. When data needs to be restored, you can import the backup data to the system to restore the integrity and accuracy of the knowledge base. In short, the system provides users with convenient and efficient medical assistance services through the organic combination of two core modules: AI intelligent consultation and knowledge base management. At the same time, the accuracy and reliability of the knowledge base are ensured by the careful maintenance of the administrator and the guarantee of the data verification mechanism. In the future, we will continue to optimize and improve system functions to provide users with a better medical service experience.

Key technology

Sparse matrix compressed storage

In the medical field, the accurate recording and storage of disease symptoms are of vital significance for the diagnosis, treatment and follow-up research of diseases. However, due to the diversity of diseases and the complexity of symptom manifestations, it is a challenge to store this information efficiently and accurately. To solve this problem, a sparse matrix-based storage scheme for disease symptoms is proposed in this study, which aims to optimize storage space and improve access efficiency. To store disease symptoms in the database, we set up a simple numerical system: 1 means that the disease has this symptom, 0 means that it does not. This binary representation is concise and easy to be processed by computer. Next, we store the symptoms of all diseases as a matrix. In this matrix, each row represents a disease and each column represents a symptom characteristic. For example, if we have six symptom features

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(fever, cough, diarrhea, skin problems, bloodthirsty eyes, and insomnia) and five diseases (common cold, pink eye, dermatitis, rhinitis, and asthma), then we can construct a matrix of five rows and six columns. However, given that the vast majority of diseases tend to exhibit only a small number of symptoms, this means that a large number of elements in this matrix will be zeros. This kind of matrix is called a sparse matrix. The characteristic of sparse matrix is that the number of non-zero elements in matrix is much smaller than the number of matrix elements, so if the matrix is stored directly in a conventional way, it will cause a lot of storage space waste and reduce the access efficiency.

In order to solve this problem, the sparse matrix data structure is used to store the control information of diseases and features. Sparse matrix is a special kind of matrix in which the number of non-zero elements is relatively small. In order to store the sparse matrix more efficiently, we use the compressed storage technology to write the sparse matrix in the form of 3-tuple table. In this 3-tuple table, we store the value of the non-zero element and its corresponding row and column subscripts in the matrix. In this way, we can store only those non-zero elements and their location information, which greatly saves storage space. Pink eye, for example, is usually only a symptom of bloodshot eyes. In the disease symptom matrix, the row corresponding to pink eye has a value of 1 on the column "bloodshot eyes" and 0 on the other columns. If we use sparse matrix storage, then only one element needs to be recorded in the 3-tuple table: the value is 1, the row subscript is the row number of pink eye in the matrix, and the column subscript is the column number of "bloodshot eye" in the matrix. Similarly, for a disease like the common cold, which has symptoms such as fever and cough, we need to record multiple non-zero elements and their location information in a 3-tuple table. By using sparse matrix storage, we can not only save the storage space effectively, but also improve the access efficiency. Because in practical applications, we often only need to focus on those non-zero elements and their position information, and do not need to traverse the entire matrix. In addition, due to the compressed storage characteristics of sparse matrices, we can also further compress and optimize the data as needed to adapt to different storage and computing needs.

Function module AI intelligent guidance

In the user orientation interface, the user is first faced with an intuitive and friendly interface, requiring the user to first choose their gender and age. These two options not only provide the basic user information for the system, but also provide an important reference for the subsequent disease recommendation. The selection of gender and age helps the system narrow down the search for diseases and improve the accuracy of recommendations. The interface then guides the user to select the affected area. Through clear anatomical illustrations or text descriptions, users can easily locate their own diseased parts. Once a diseased site is selected, the system responds immediately, displaying a variety of common symptoms associated with the site for the user to choose from. Users can choose one or more symptoms from the list that match their condition based on how they actually feel. When the user has selected and confirmed, the intelligent module behind the system begins to work. It converts the user's chosen disease site and associated symptoms into a unique symptom vector. This vector is a digital representation of the user's condition, containing all of the user's selected symptom information. This symptom vector is then compared against a pre-stored disease symptom matrix in the knowledge base. By calculating the Jacquard similarity coefficient between the symptom vector and the disease symptom matrix, the system is able to assess the degree of

similarity between the user's symptoms and various diseases. Eventually, the system will present the user with a list of possible diseases in order of high or low similarity. The list not only contains the name of the disease, but also provides information about the diagnosis and treatment departments related to the disease, so that users can further understand and treat it. The whole process is simple and efficient, and provides great convenience for users.

Conclusion

Through the introduction of this paper, we can see the importance of AI intelligent guidance system based on Large Language Model in modern medical services. The system not only improves the patient's medical experience and the service efficiency of the hospital, but also promotes the harmony of the doctor-patient relationship. With the continuous development and application of artificial intelligence technology, the AI intelligent guidance system will become more and more perfect, providing patients with more convenient and accurate guidance services. At the same time, we also expect more medical institutions to introduce AI intelligent guidance systems to jointly promote the improvement of medical service quality and efficiency.

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