Research on Intelligent Prescription Review System Based on Medical Big Data

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Abstract. According to statistics, the incidence of adverse drug reactions in my country is 10%-30%, and about 190,000 people die from serious adverse drug reactions each year. Therefore, relying on the pharmaceutical knowledge base to provide clinicians with real-time rationalized medication diagnosis and treatment opinions, and to prevent the occurrence of contraindications, overdose and other wrong medications, is an important topic worthy of medical information research. Therefore, this article introduces the expert system and ontology technology into the application of smart medical services, and builds a prescription intelligent review system based on the pharmacy knowledge base, and through the construction of prescription ontology, pharmacy knowledge base modeling, and review process reorganization During the process, AI intelligent review of prescriptions issued by doctors is carried out in real time.

Keywords: Expert System, Ontology Technology, Pharmacy Knowledge Base, Prescription Review System

1. Introduction

In July 2018, the National Health Commission announced the "Regulations for Prescription Review of Medical Institutions", stating that "all prescriptions should be reviewed and approved before they can enter the pricing and charging and deployment links, and prescriptions that have not been reviewed and approved shall not be charged and deployed". "Medical Institutions should actively promote the informatization of prescription review and provide necessary information for prescription review through the information system". At the same time, hospital informatization construction with electronic medical records as the core is also one of the important contents of medical reform. In the "Electronic Medical Records System Functional Application Level Evaluation Methods and Standards (Trial)", it is clearly required to prescribe physicians (medical entry, pharmacist review). Fang and other links need an intelligent system to conduct intelligent review of rational drug use

In order to implement the policies and regulations governing the rational use of drugs in hospitals and improve the level of rational use of drugs in hospitals, this research group has conducted in-depth research and exploration, conducted related theoretical studies and technical attempts, and chose to Establish a knowledge base for rational drug use, and deep integration with the outpatient/resident..
doctor workstation system and prescription (doctor's order) system, and develop a hospital rational drug pre-review management system based on the AI pharmacy knowledge base and apply it to the clinic to realize the pre-doctor station Closed-loop management of rational drug use risk including medication monitoring reminders, prescription review by traditional Chinese pharmacists, and post-prescription comments.[3-5]

In summary, this text relies on the medical ontology knowledge base technology, through the establishment of a rational drug use knowledge base, and deep integration with the hospital doctor’s workstation system and the prescription (doctor order) system to develop a hospital rational drug pre-review formula based on the AI pharmacy knowledge base The management system is also applied to the clinic, realizing the closed-loop management of rational drug use risk such as pre-event doctor station medication monitoring reminders, in-event computer AI (or pharmacist) review and post-event prescription comments.

2. Prescription intelligent review system

2.1. Architecture of prescription intelligent review system

The intelligent prescription review system based on the pharmacy knowledge base is a system tailored for hospital clinicians and pharmacists. The system is based on the framework of the pharmacy knowledge base constructed by ontology knowledge, and is a technical system that transmits and calculates the collected data through the Internet. The specific architecture diagram is shown in Figure 1.

![Figure 1. Architecture diagram of prescription intelligent review system.](image)

It can be seen from the figure that the intelligent audit system includes three parts: the interface layer, the storage layer, and the service layer. The storage layer includes databases and intelligent knowledge reasoning engines.
2.1.1. Interface layer
This layer mainly calls real-time monitoring services and data extraction services through service registration components, obtains prescription data from business systems such as hospitalization systems, outpatient systems, and HIS systems, and calls mapping rule services and ontology construction services for data cleaning and integration. Structured prescription data, while generating the local ontology model. This layer is mainly used to obtain the prescription data required by the reviewer system and convert the cost body model.

2.1.2. Storage layer
The database mainly includes prescription ontology database, pharmacy knowledge base, rule database and process database. Among them, the ontology library mainly stores the OWL description mode of various prescriptions; the pharmaceutical knowledge base is used to store the attribute description information and drug association information of drugs; the rule library mainly stores the corresponding rules of various drugs and various businesses; the process library mainly stores the system Various process services that the reviewing party can provide. The independent storage of these four types of libraries effectively ensures the independent expansion of medicines and services.

Intelligent knowledge reasoning engine, this layer can shield the complexity of system data storage, make users face a simple and unified data use environment, and focus on the application of drug use context services. The middleware uses the diagnostic knowledge generator system to ensure that the electronic prescription generates structured medical data results; the load balancer ensures the stable operation of the platform system; the message queue ensures the accuracy of the platform operation; the poller controls the operating frequency of data collection. In addition, the basic data of medical diagnosis is realized through the acquisition module; the rapid construction of the prescription intelligent diagnosis situation is realized through the inference module; the application of basic services is realized through the service scheduling module.

2.1.3 Service layer
This layer mainly provides the results produced by the knowledge management engine to the application system in the form of services. The main implementation methods include Web Service, API, push service and search engine. The main content is to pass the result information of drug compliance to the proposed application through the query interface service.

2.2. The operating process of the intelligent review system
The intelligent review system is an open system. The core of the process takes the prescription -tions or doctor orders of the existing medical management system as the input source, gathers various information metadata into the data center, and builds the prescription ontology graph to associate with the pharmacy knowledge base. Realize the service of intelligent review process -ing, the specific operation process of the system is shown in Figure 2.
It can be seen from the figure that whether it is an outpatient prescription or a hospital order, through the deep integration with the doctor’s workstation system, through the reminder and monitoring of the pharmacy think tank, the result of the intelligent prescription review is formed. For risky prescriptions, after the doctor chooses to save the prescription, the system automatically captures the flow back to the doctor review center. The central pharmacist of the review center conducts a second review in conjunction with the individual patient, and the confirmed risk of prescription medication can be returned to the doctor for revision. The whole system achieves the purpose of making full use of the existing resources of the hospital and improving the system development level and application effect.

3. Key Technologies of Intelligent Auditor System

3.1. Construction of the prescription ontology
Prescription ontology construction is the extraction of unstructured prescription text from medical concepts. It can be roughly divided into the following processes: file format preprocessing, Chinese word segmentation and part-of-speech tagging, prescription knowledge dictionary construction, removal of related stop words, The main tasks of the process of domain correlation consistency calculation include:

- **File format preprocessing:** Preprocess the text of the prescription first to remove information irrelevant to the diagnosis letter and medicine;
- Chinese word segmentation and part-of-speech tagging: Chinese word segmentation and part-of-speech tagging for prescription content through the open source word segmentation system;
- Prescription knowledge dictionary structure: In order to improve the accuracy of Chinese word segmentation and prevent some professional terms in the medical field from being divided into multiple strings, so in the process of Chinese word segmentation, a dictionary of knowledge in the field of medical diagnosis is introduced.
- Remove related stop words: For prescriptions containing a large number of structural words, such as auxiliary words, adjectives, adverbs, etc., most of these words are just structural words and cannot represent the topic of a certain field, so in order to reduce the concept extraction process Design a stop vocabulary list and delete it;
Domain relevance consistency calculation: using statistical algorithms and the concept of forward maximum matching algorithm based on the medical domain knowledge dictionary to calculate the domain relevance consistency.

3.2. Pharmacy knowledge base model
The medical knowledge base consists of three parts: one is a rule library, which stores the rules of medical knowledge and clinical trial knowledge in the problem domain; it is a condition library, which can only be used when each rule is established and the weight of its conclusion is greater than a preset threshold. The rules are true; the third is the dynamic knowledge base, which includes the data entered by the user during the operation of the system, the rules for system reasoning, the conclusions drawn according to the rules, and the operation process record when interpreting user questions.

The knowledge base mainly describes the clinical use information of drugs through the following six aspects:
- Drug information: drug name, usage and dosage, electronic version of drug instructions, etc.
- Incompatibility: a list of drugs and drugs that are incompatible with this drug
- Contraindications: a list of contraindicated clinical problems
- Drug management: drug medical insurance information, etc.
- Medication guidelines: medication recommendations maintained by clinical pharmacists
- Adverse drug reaction: description of adverse drug reaction

Through the integration of the above six aspects, we defined drug_desc knowledge entity in the knowledge base (as shown in Table 1)

| Attribute name         | Property description          |
|------------------------|-------------------------------|
| Name                   | Drug name                     |
| Code                   | Drug code                     |
| Route                  | Route of medication           |
| Max_Freq               | Maximum frequency of medication|
| Min_Freq               | Minimum frequency of medication|
| Max_Dos                | Maximum dose                  |
| Min_Dos                | Minimum dose                  |
| Max_DailyDos           | Daily cumulative maximum dose  |
| Individualized_Dos     | Personalization               |
| Unit                   | Dosage unit                   |
| Drug_Interaction       | Interaction drugs             |
| Pro_Def                | Contraindications             |
| Preg_Category          | Pregnancy risk                |
| Policy                 | Types of doctors              |
| ADE                    | Adverse reactions             |
| Disolvent              | Allowable solvents for drugs  |
| Disolvent_Dos          | Vehicle dose                  |
| Permission             | Prescription rights restriction|
| Adapt_char             | Adapt to symptoms             |

Through the above entity modeling and entity association, the corresponding matching rules can be provided to the prescription review intelligence according to the drug knowledge base. It is possible to establish a monitoring catalog for a wide range of drugs in the prescription, which is used to implement an intelligent drug review expert system, so as to quickly realize the rapid review of the prescription.

4. Conclusion
Aiming at the problem of misprescribing drugs that frequently occur in the process of medical
diagnosis, the paper proposes to use the idea of an expert system to build an intelligent prescription review system architecture based on the pharmacy knowledge base, and gives the specific application process and key technologies. The system is suitable for business and management departments such as top three hospitals, community hospitals, health and health commissions, etc. The system can greatly reduce the risk of drug use and reduce the cost of prescription review. Therefore, it has high research and application value.

In the follow-up work, we will further improve the review process of the system, and conduct in-depth research on the automatic construction of the prescription ontology model and the intelligent improvement of the knowledge base.

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