Big Data Analysis Technology Application in Agricultural Intelligence Decision System

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***Abstract*—Agricultural intelligent decision system has a positive practical significance for guiding agricultural production, which can provide scientific basis for agriculture. Big data analysis technology can effectively improve the performance of intelligent decision system. The research development of the agricultural intelligent decision system is given. The classification of the agricultural decision system is introduced. The frame designation of the intelligent decision system is studied, and the design process is given.**

Keywords-big data analysis; agricultural intelligence decision; frame designation

I. INTRODUCTION

Agricultural intelligent decision system is an application program, which provides answers according to authoritative experts in related fields for those application problems that need expert knowledge or a knowledge base in a specialized field to solve [1].

Agricultural intelligent decision system has a large number of authoritative experts in agriculture experience, information, data and results constitute the knowledge base. It can use its knowledge and method to solve the problem of simulation of agricultural expert judgment. Intelligent decision system can solve the problems of agricultural production. [2-3]

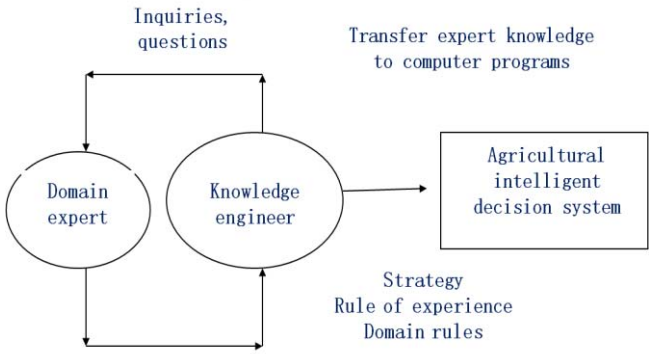

Figure 1. The structure of agricultural intelligent decision system

In the late 70s, plant pathology expert system using computer technology is developed by Illinois University, which was mainly for crop diseases and insect pest diagnosis.

In the mid 80s, the agricultural decision system has shifted from single disease diagnosis to production management, economic analysis and decision-making and ecological environment. There were some achievements in the United States, China, and Japan and European countries.

Since 1990s, with the rapid development of computer technology, AI technology, database technology, 3S technology and automation control technology, agricultural information technology has entered a new development period, and intelligent agriculture decision system has been developed successively. Intelligent agriculture decision system is mainly a variety of intelligent technology integration in the field of decision system, such as neural network, WEB technology, intelligent greenhouse, 3S technology, the use of modern means of data processing, a new processing of data. The information technology enriches the connotation of agricultural decision system, which improves the decision accuracy, intelligence and practical. [4]

The single function of agricultural decision system in this stage is the initial stage of agricultural decision system. The time is at the end of 1970s to early 80s. Because the CPU frequency and data processing capability is low, relational database has just started. The agricultural decision system function is single to solve specific problems, such as diseases and pests pest prevention, irrigation management, hazard prediction. The decision system for the diagnosis of soybean disease and insect pests developed by the Illionois University of the United States, as well as the cotton water management decision system developed in 1982.

In the early 1990s, the Agricultural Engineering Department of Florida University in the United States developed decision support system for agricultural environmental geographic information system. U. Singh established the decision-making model for crop simulation using the combination of CERES and GIS model in semi arid area in India. A. D. Gier by GIS established the Indonesia regional spatial analysis model of agricultural production decision support system. [5-6]

II. THE STRUCTURE OF AGRICULTURAL INTELLIGENT DECISION SYSTEM

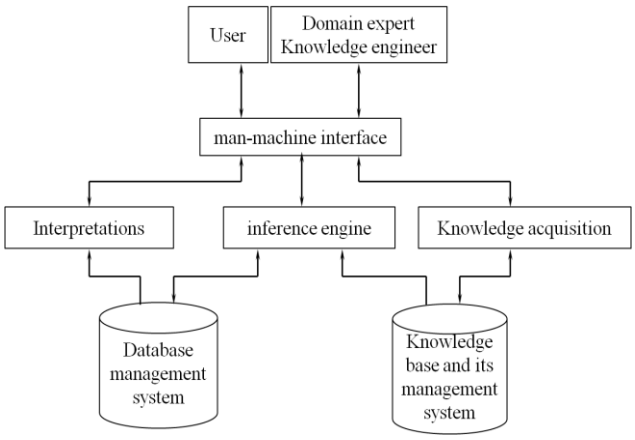

Figure 2. The design process of agricultural intelligent decision system

A. *Knowledge Database*

The knowledge base is mainly used to store the expertise of experts in the field of agriculture. Knowledge base is an important object of reasoning machine, and the quality of knowledge directly affects the efficiency of the decision system.

B. *Integrated Database*

Integrated database, also known as global database or general database is used to store the intermediate data information obtained from the initial data of domain or problem and the reasoning process.

C. *Reasoning Machine*

The reasoning machine is used to memorize the rules and control strategies, so that the whole agricultural decision system can work in a logical way. A reasoning machine can get conclusions based on knowledge, rather than simply searching for ready-made answers. It includes two parts of reasoning method and control strategy.

D. *Knowledge Acquisition*

The process of knowledge acquisition can be regarded as the process of transferring the professional knowledge of agricultural experts from the source of knowledge to the knowledge base. Knowledge acquisition process includes identifying the necessary knowledge and formalizing it when the knowledge base is created. The knowledge base is often found to be wrong or incomplete, so the knowledge acquisition process also includes modification and extension of the knowledge base.

E. *Interpretations*

It can explain the behavior of the agricultural decision system to the user, including the correctness of the reasoning conclusions and the reasons for the system output of other candidate solutions.

F. *Man-Machine Interface*

It enables the system to communicate with the users. Users can input the necessary data, raise questions and understand the reasoning process and reasoning results. The system requires the user to answer questions, answer the questions raised by the user and make the necessary explanation through the man-machine interface.

III. THE DEVELOPMENT OF AGRICULTURAL INTELLIGENT DECISION SYSTEM

Knowledge acquisition is an important part of agricultural intelligent decision system, which gathers relevant professional knowledge and experience data from the agricultural experts, and organizes and summarizes a written symbol form. Knowledge acquisition determines the knowledge representation and reasoning methods, establishing knowledge base, writing inference procedures, and debugging and modification.

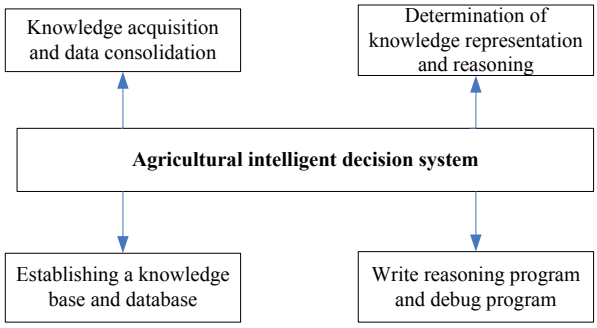

Figure 3. The major component of agricultural intelligent decision system

The major component of agricultural intelligent decision system concludes four parts, which is Knowledge acquisition and data consolidation, determination of knowledge representation and reasoning, establishing a knowledge base and database, and write reasoning program and debug program.

Knowledge acquisition and knowledge representation and knowledge use are three key technologies for the construction of an expert system. The basic task of knowledge acquisition is to obtain knowledge for the decision system and to establish a perfect and effective knowledge base to meet the needs of solving the problem in the field of solving. The extraction of knowledge is identified, understood, screened and summed up in order to build a knowledge base, which includes artificial analysis method, statistical analysis method, natural language understanding method and knowledge compilation method.

Knowledge conversion refers to the conversion of knowledge from one expression to another. Knowledge transformation is generally divided into two steps. The first step is to transform knowledge extracted from experts and documents into a knowledge representation mode, such as production rules, frameworks and so on. The second step is to transform knowledge expressed in this pattern into an internal form that can be directly utilized by the system. The previous work is usually done by a knowledge engineer, and

the later work is generally implemented by input and compilation.

Knowledge input is the process of sending the knowledge represented by appropriate knowledge to the knowledge base by editing and compiling. At present, knowledge input is usually achieved through two ways, one is to use computer system to provide editing software, and the other is to use specially compiled knowledge editing system, which is called knowledge editor. The advantage of the previous one is simple and can be used directly, reducing the work of making a special knowledge editor. The advantage of the latter is that specialized knowledge editors can implement corresponding functions according to actual needs, making them more targeted and applicable, and more in line with the needs of knowledge input.

According to the degree of automation of knowledge acquisition, knowledge acquisition can be divided into two ways: non automatic knowledge acquisition and automatic knowledge acquisition. Non automatic knowledge acquisition communicates with domain experts, read the relevant literature, and obtain the original knowledge needed by the decision system. The original knowledge obtained is analyzed, arranged and summed up to form the knowledge terms expressed in the natural language. Knowledge terms are expressed in the knowledge representation language, and the input is edited by the knowledge editor.

IV. Big Data Analysis Technology Application in Agricultural Intelligent Decision System

A. Big Data Analysis System Frame

Big data analysis technology can improve agricultural intelligent decision system performance. The big data analysis system frame is shown in Figure 4.

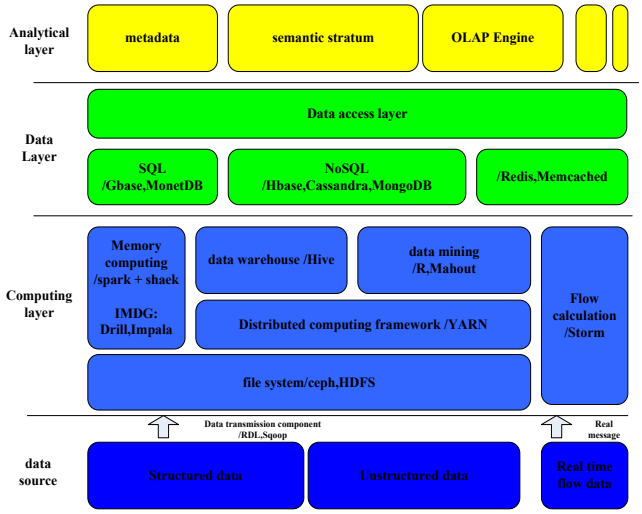

Figure 4. The big data analysis system frame

Data source can also be divided into offline data, approximate real-time data and real-time data. According to the classification, the structure of data storage is explained, especially the stream data. Its core is data continuity and fast analysis.

Spark in memory computing is the latest work of UC Berkeley. The idea is to load all the data to be processed by using all the memory in the cluster, which can save a lot of I/O overhead and hard disk drag, so as to speed up the computation. Impala comes from Google Dremel, which makes good use of the distributed cluster storage and efficient way to speed up the query speed of large data sets. The file storage system is Hadoop. Now the big data technology is Microsoft and HDFS as the storage technology. The upper YARN is MapReduce. Hive and Pig Latin is upper application using the idea of SQL to query the data on Hadoop.

Mahout is a tool that integrates data mining, decision support and other algorithms. It contains all the classic algorithms based on Hadoop, and it is good for reference as the core algorithm set of data analysis.

Application is displayed by form and icon. In fact, a detailed, colorful and authoritative data icon report is the best way to present to customers. The data are displayed with Tableau and Pentaho tools.

B. Wheat Agricultural Intelligent Decision System

The text use big data analysis technology developing wheat agricultural intelligent decision system. The knowledge base is used to store domain knowledge, which concludes sowing date and density knowledge, nutrition and fertilization knowledge of wheat, knowledge of water management in farmland, knowledge of growth and development of wheat, knowledge of the use of growth regulators and biochemical agents and pest and rodent control knowledge.

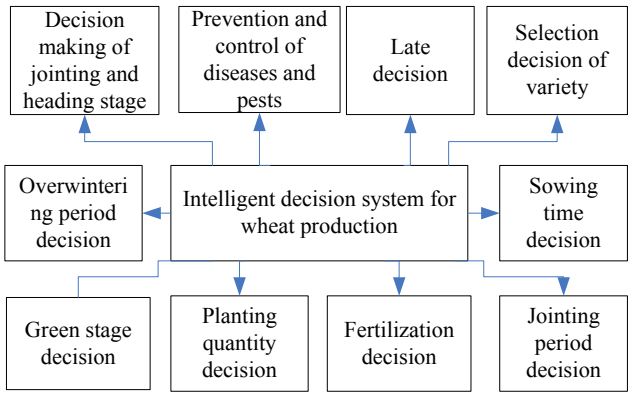

Figure 5. The structure of intelligent decision system for wheat production

The intelligent decision system for wheat production concludes decision making of jointing and heading stage, prevention and control of diseases and pests, late decision, selection decision of variety, sowing time decision, overwintering period decision, green stage decision, planting quantity decision, fertilization decision, and jointing period decision (Figure 4).

V. CONCLUSION

The rapid development of big data technology provides a new technical means for the research and development of agricultural intelligent decision system. It can effectively improve the processing speed and accuracy of the agricultural intelligent decision system, and can provide guidance for agricultural production. The application of big data analysis technology and artificial intelligence technology in the agricultural intelligent decision system is the next development direction.

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