

Application of expert systems in business management information recovery

Abstract

Despite the relatively large number of theoretical studies that have been conducted in the field of using expert and intelligent systems in information retrieval, relatively few retrieval systems can be observed in which the capabilities of expert systems and business management have been used. In other words, in most of these systems, the use of traditional patterns of information retrieval such as the use of information systems has been observed. The review of related texts shows that most of the developments in this field have been related to the concepts of intelligent text processing, intelligent interfaces, and intelligent agents. This paper tries to survey the expected goals of intelligent and intelligent systems and to improve information and business management. Finally, with an approach to this issue, it is emphasized that the nature of some processes in retrieving information about the user's true information needs is complex so it is difficult to completely replace expert systems and business management.

Keywords: *Information, Business Management, Expert system, Intelligentization*

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Introduction

Many articles and texts have been written about the concept and applications of expert systems and business management. However, the search in the continuous edition [1] showed that relatively few articles have been written about the objective applications of expert and intelligent systems in information retrieval in business management. The purpose of this article is to answer the question of whether expert systems and business management can be used in information retrieval systems, and if so, what is their objective use in such systems. A review of research conducted in the field of librarianship and information in this field shows that there are ambiguities regarding the objective applications of expert technologies and business management in information retrieval. Perhaps, one of the reasons for this is the publication of texts and articles that have emphasized more on theoretical aspects. This is highlighted by Lancaster and Warner in the book 'smartphone use' in library and information services [2]. There is ambiguity on whether the systems discussed in such texts and papers have been objectively tested and used in databases that contain different types of information, on compressed disk or continuous networks, or whether only their structure and functions are theoretically discussed, or are presented in the best form in the form of a pre-sample.

Two approaches can be seen regarding the use of expert and intelligent systems in different texts. Several authors believe that the computer can virtually simulate almost everything that humans do. A clear example of this claim can be seen in the design of programs that can play chess at a very high level. Some other authors consider this claim to be exaggerated and claim that the computer can never truly perform intelligent actions. Now this question is raised, regardless of the controversial debates between these two ways of thinking, what objective applications have expert and intelligent systems

been able to perform in information recovery, and whether the nature of information recovery is such that expert and intelligent systems can be used to improve performance. It means the retrieval of "the most information related to the user's information needs in management" in a database. There is no doubt that a computer can do some things (such as storing and retrieving a large amount of information or performing complex statistical analysis) better than a human, but this question must also be answered in cases where a decision needs to be made based on the analysis of the user's information needs and its correspondence with the content of a document (various types of information including text, audio, and image) available in an information retrieval system, can an expert and intelligent systems make a fundamental improvement in the process of recognizing such documents by meeting the information needs of end users? Determining its relevance through the user or experts is a subject with many complications. For example, people's informational needs and subjective approaches to dealing with a document may be different. Also, even the needs of a single person may vary at different times. Such questions have been discussed in the field of information retrieval from a hermeneutic point of view, which emphasizes more on subjective aspects and different interpretations of a subject [3].

Therefore, the fundamental question is whether expert and intelligent systems can be used in a subjective category, i.e. matching the search language with symbols representing the content of the documents on the one hand, and the information needs of the users on the other hand. In other words, all three main elements in information retrieval, i.e. search language, descriptors representing the content of documents in a management information base, and the need for information expressed in the business management system of the user are under the influence of the hermeneutic point of view. Of

course, another approach can be observed in which the informational needs of users are not emphasized. For example, in the plans of Granfield one and two, where the research of information retrieval has been followed in an experimental and laboratory manner, the information needs of the users have not been paid attention to, and only the improvement of the efficiency of the information retrieval systems from the point of view of matching between the search language and the symbols representing the content of the documents. The test has been taken.

Such an approach can be seen in the texts related to the field of computers. To be able to partially answer the question raised in this article, it is possible to discuss the purpose of information retrieval systems in management while looking at the possibilities and capabilities of expert and intelligent systems.

What is an expert and intelligent system?

a. Information systems in management

Information systems in management are defined as a category of computer-based systems that are used in different organizations to make decisions and organize management solutions. Due to the fast processing capability of computers and performing calculations with the highest accuracy, they ease the work of managers while reducing the percentage of errors. Information processing is done quickly and presented to the managers for decision-making, planning, and implementation.

The information system is an integrated system and works on a user-machine basis to provide the necessary information to support decisions and operations. These systems consist of 5 parts which are as follows:

- hardware
- software
- Human user
- Communication system
- Information

The performance of these systems is that first the input and modification of raw data is received from the human user, then the processing operation is performed by the CPU on the information inside the system, and finally, the output is delivered to the user under the name of information.

To organize the information processed inside these systems, a database is needed that, in addition to storing the information inside these systems, can perform search operations and prepare the results according to the input information based on the search.

Expert System

Ford has defined the expert system as follows: "Computer programs with knowledge, information, and databases that are in dynamic communication with each other and try to solve

problems and decision-making processes on a relatively limited scale, such as what humans do."

The specific characteristics of the expert system according to Ford [4] are :

- The ability to cope with data that may seem uncertain or incomplete (e.g., the system can provide an answer such as " " I don't know " " or " possibly ").
- The ability to reach conclusions with certainty and where it is necessary to provide several approaches or solutions for a specific problem (when there is no definite answer to a problem).
- Ability to explain why a specific question is asked and how the system can find a suitable and specific answer for it.

In his book, Ford has also explained well the differences between the expert system and other algorithmic computer systems:

"What is relatively considered a new issue in information storage and retrieval is the ability to store and retrieve not only numerical and algorithmic data but also, symbolic and discovery data. With the development of software and hardware, performing processes based on discovery knowledge with greater ease. And it can be done at a lower cost. Symbolic knowledge (as opposed to numerical knowledge) is what we use to make our decisions and judgments, and this is often achieved by accessing conclusions from the available evidence.

Spangler and May [5] have explained the expert system in the encyclopedia of librarianship and information as follows:

An expert system is a software tool developed based on artificial intelligence technology. In the beginning, the purpose of designing expert systems was to simulate and possibly replace human reasoning ability in dealing with various issues. But today, more normal functions are expected from expert systems to help perform some tasks such as diagnosing diseases, controlling processes in the production cycle of products, financial analysis, data interpretation, and the like.

The theoretical relationship between expert and intelligent systems and the information retrieval process

The points mentioned in the above definitions are briefly mentioned and information is given about the logical connection of each of them with the recovery process:

A. Simulating human reasoning and decision-making power. This question can be raised as to what process should be simulated by the machine in the information retrieval system, which was previously dependent on human reasoning power. Perhaps one of the most important roles of humans in the stage of information retrieval Selecting keywords related to the desired topic and combining them through different operators and additionally, recognizing the relevance of the retrieved documents to the desired topic.

It is debatable whether such actions need reasoning or not. Undoubtedly, at least the information field seeks more than the mere matching of search keywords (stated, not actual, information needs) and subject symbols in documents. However, much experimental and laboratory research has been carried out under the title of Granfield designs one and two, in most of which such an approach has been emphasized.

Perhaps, the above process does not need much human reasoning power and the machine can perform the exploration process through sub-systems such as thesauruses and vocabulary files.

If the goal is to respond to the actual information needs of users, then the power of human reasoning is important in identifying the rate of the keywords of the users on one hand and the retrieved documents. Therefore, at least theoretically, if a military seeks to respond to such a need by eliminating or decreasing the role of humans (often subject specialists and sensing), expert systems can play a fundamental role.

B. Transfer of expertise and learning through feedback. In most news and smart systems, a basic element is needed, and that is the transfer of human expertise in a form that can be presented to a system. In fact, the generation of rules or their combination with semantic networks or different formats must be transferred to the system by an expert.

An expert may have acquired and entered the required knowledge through various methods such as interviews, observation, or experience. But collecting knowledge in the field of information retrieval by experts to encode them for the computer is a difficult task because much of the knowledge obtained in this field is based on assumptions that can be easily questioned. For example, the concept of relevancy and information requirement is among the pre-assumptions that have not been observed in many studies done in the field of information retrieval. Hence, the gained knowledge based on such research is faced with ambiguity. Pours [6] in his article entitled "Information Retrieval: Experimental Patterns and Statistical Analysis" criticizes the validity of some research conducted in the field of information retrieval.

For example, he points out that according to statistical principles, the number of searched keywords, the number of retrieved records, the number of people who decide whether the retrieved documents are relevant or not, and the number of judgments made regarding the relevance in information retrieval research should match. With sampling rules to generalize the obtained results, for example, to an entire database; however, it is almost impossible to sample the keywords that users may choose for their search. Therefore, the question arises as to how far the knowledge obtained from the field of information retrieval based on such research can be transferred to an expert or intelligent system. This issue is closely related to the opinion of McCarthy and Hess that was

mentioned earlier; Because the problem that the field of artificial intelligence is facing is related to the epistemological and exploratory aspects of the issues.

If we accept that the knowledge required in the field of retrieving administrative information to transfer to an intelligent and intelligent system is faced with fundamental problems to determine and implement duties or rules, the question is whether, in other ways, it is possible to design and develop such systems.

Some experts in the design of expert systems in information retrieval have emphasized machine learning capability. For example, in the information retrieval system, the computer will be able to use feedback from users about whether or not the documents are linked or not to be retrieved, for future decisions.

One of the most common techniques of computer learning in expert and intelligent systems software is the automatic generation of rules. Through such software, a knowledge-based system can be produced automatically. In fact, these softwares do not explicitly use "if" and "then" commands to provide rules, but they automatically generate the required rules. However, in the meantime, the system designer must specify the desired initial samples for the program.

This way, this software can identify rules in the data. The implied meaning of this point is that the program can extract the desired rules from the information related to the examples and samples provided and provide knowledge that was not previously created by the program designer. In fact, such systems are able to produce new knowledge that in certain cases was not accessible to humans before.

In many cases, users search for so-called and refine their exploration and thus may achieve relevant and relevant information. Now, if a military can learn at least theoretically from feedback and user feedback to correct or change some functions in the retrieval system (e.g., it can combine keywords with correct spelling), or combine them with other keywords (often via thesaurus or other feedback), or to use different search interfaces based on the user's level of knowledge (...), one can find a level of expertise.

C. Performing actions that require human expertise. Expert systems are computer program management that can perform the normal tasks of people who have a special skill or expertise. The purpose of designing expert systems is to make some special skills available to managers. The skill of searching in different information bases with different search interfaces and commands is often specific to search specialists in libraries and information centers.

Now, if a system can create an interactive environment to replace such skills, it can be considered an expert retrieval system. For example, at least theoretically, a system that is able to establish a logical connection between the stated need and

the actual need of the user through interviewing the reference, and taking the best exploration strategy, can be considered an expert. Of course, this question is raised when performing such processes using a human (exploration specialist) is faced with many problems and complications, how will the machine be able to improve it?

In other words, in knowledge-based experience systems, knowledge and skill in the field of management should be included in this system and asked to use in different and needed conditions. The experience and skill gained by exploration experts (such as cataloging and indexing) is something that cannot be easily provided through an expert system. However, researchers in this field are trying to find out the user's real need as much as possible based on the expressed need: a problem that mankind has not been able to solve completely for centuries.

In the example below, a hypothetical example of a knowledge base is shown so that users can be guided to the information base related to their needs by using questions and answers:

If the subject searched by a user is "Islam".

And the type of reference sources to be searched for are Persian magazine articles

And the full text of the articles is required

Then it is recommended that the user's query be made in the "full-text profile database".

However, using the semantic web, it is relatively easy to provide a system that can automatically assist users in micro or macro searches. This process can be done by including rules that use a semantic network to provide conclusions about the relationship between terms. One of the systems that use the structure of the semantic network in the retrieval of management information is called MenUSE. This program offers the possibility of effective continuous search to users, without needing much training or experience in information exploration. The basis of the MenUSE program is a management subject heading. [7] The purpose of developing this program is to eliminate actions that require human expertise - that is, exploration by experienced subject matter experts.

D. Judgment even though the available evidence is unknown or incomplete. Perhaps, the most important judgment that must be made in the exploration process is the real need of the user, while its dimensions are unknown and often the information obtained about it may be incomplete. It has been emphasized that there should be a difference between the needs expressed by the end users and their real needs.

One of the most important ways to understand the actual need of users is the reference interview. Therefore, at least theoretically, if a military is able to provide a mechanism for an interview with the user before the exploration and after the recovery phase, one can observe a level of expertise. Whether

its knowledge base can respond to any question raised by the user and track it logically, although theoretically through "if" and "so" the creation of such a base will be costly. The experience of subject matter experts and managers over the years has not been foreseen in the design of pre-nasal questions or guessing the need for their information from behavior and even the appearance of users is something that cannot be implemented in the machine military form.

For example, is an expert system in response to the question raised by a self-taught student and a doctorate in physics on relativity? The ability to explain why a particular question is asked; who is characterized by what features it raises; what is the actual need of an individual to access the desired information; and finally, how the system can respond appropriately to such questions is almost impossible. The main challenge of the current research is to understand how intelligent and intelligent systems will be able to solve the issues of hermeneutic and subjective issues relating to the recognition and real need of users in the retrieval of information.

E. The ability to reach conclusions with certainty : providing solutions to problems. The ability of any system to deal with problems and provide solutions with certainty from the inferences obtained is one of the most important characteristics of any expert system.

In everyday life as well as professional and scientific decision makers, often our conclusions about various issues may not have certainty and are accompanied by expressions such as maybe, etc. Can a smart or expert system achieve a high degree of reasoning, decision-making, and intelligence in the process of matching users' questions with thematic symbols of the documents available in an information base and with their real information needs that may not be reflected in the questions (i.e. keywords search item) establish? Perhaps the ranking of search results and weighting of keywords can be considered as a type of conclusion with uncertainty. In fact, some believe that by displaying the possible relevance of user queries and retrieved documents (often by showing the percentage of relevance), some kind of conclusions can be expressed in the context of information retrieval. When a document is recovered at a degree of 10 %, the information retrieval system in management has not provided full certainty about its full relevance to the managers' needs. However, the self-assessment of what documentation (whether in terms of rating of exploration results or in terms of the degree of relevance to the needs of the managers) is again in a cycle of ambiguity, which is similar to that in the measurement of relevance in information retrieval systems.

F. Using exploratory knowledge instead of algorithmic logic. In many definitions of expert and intelligent systems, it is emphasized that they use heuristic knowledge (knowledge that

seems to work correctly based on practical experiences) instead of algorithmic logic. These programs perform actions beyond the processing of alphanumeric data. Exploratory knowledge are the empirical rules that are often used by professional managers of organizations.

These rules differ from algorithmic rules and provide short paths to solve different problems, and need less force and time to process than algorithmic rules. Heuristics can be used in situations where algorithmic rules are unknown or inappropriate. A hypothetical example of an exploratory logic that can be used in a data retrieval system is shown in the following example:

Document A is about information organization

The term information organization is in the subgroup of the term macro management

Therefore, Document A is also about management

The above example can be used to retrieve information to increase the likelihood of user access to other relevant sources of information that he needs. In this way, the user who seeks information about the " organization of information " can be obtained from other police-related documents that have the management subject and possibly the organization of information. In most non-expert computer systems, decisions are made based on mathematical and algorithmic rules (such as statistical and mathematical analysis programs). In other words, the reasoning ability of such systems is applicable only in connection with a pre-defined problem. Algorithmic logic in the information retrieval system can be considered similar to the matching of the search term and the symbols in a document or the analysis of the frequency of repetition of keywords in different fields. On the opposite point, exploratory logic is supposed to use reasoning capacities based on a knowledge base to solve problems for which a solution has already been obtained experimentally. Now this question is raised, under what conditions a model similar to discovery logic can be implemented in an information retrieval system? In other words, when can we take a step beyond the mere matching of search keywords with the symbols included in a document (which, of course, has never been the ultimate goal of the information field)?

It may be concluded that the retrieval of management documents related to the real information needs of users based on the stated needs is something that can only be implemented by using discovery logic in expert and intelligent systems. As it was said, discovery logic is nothing but the rules obtained experimentally from the skills and experiences gained by humans. Therefore, at least theoretically, the creation of a knowledge base in an expert system can only be achieved by using empirical knowledge that is based on studies about managers (such as information-seeking behavior, user interaction with the search interface, information needs, and

the like). It can be found. Therefore, until the knowledge needed to create such an environment can be provided through various research, the creation and development of a recovery system based on discovery logic will be far from expected.

Objective applications of expert systems in management information retrieval

Lancaster believes that, for many years, research in the field of information retrieval has been carried out by a few researchers and their research has had very little impact on commercial products. For example, the products of service providers and management information bases in the world, such as Dialogsal, have been using Boolean logic approaches in information retrieval to match search terms and documents in their databases. Currently, many suppliers of these products do not use the achievements and results of research in the field of information retrieval.

The function that is seen in the process of most information retrieval systems is the matching of a part of a text (often words or search terms) with documents in a database (which can include bibliographic information, full text, or multimedia). During the past four decades, various techniques have been proposed and used to improve this seemingly simple function, so that more effective and efficient tools can be developed to access the relevant information needed by users.

The result of such research is the development of complex information retrieval systems that often use statistical analysis or natural language processing techniques. However, such systems cannot be called "smart" recovery systems. Because, as mentioned, in an expert and intelligent system, it is more appropriate to use symbolic and discovery logic instead of algorithmic and mathematical logic.

Lancaster and Warner believe that there have been valuable studies in the field of management information retrieval systems, some of which have led to the design of very complex information retrieval systems. In some of these studies, statistical processing methods, as well as natural language, have been well used to match the search terms with the records in the database, a clear example of which can be found in the research of Salton and McGill [8,9] Fricks and Biza-Yetz. [10], and Korfhij [11] observed. However, the processes that take place in such systems are not intelligent at all. [12]

Feedback perception of how to relate to how the final use of relevant information items is identified in the first stage of information retrieval and then the expert system automatically generates new search terms based on the feedback used.

- Retrieval of multimedia information (Multimedia Retrieval): access to images, audio, and video parts in information bases, without including written descriptive information about them.
- More effective information retrieval (More Effective Retrieval): improving comprehensiveness and hindrance in information retrieval.

- Vocabulary Expansion: Expanding the search vocabulary beyond the terms explored by the end user.
- Efficient information retrieval (Efficient Information Retrieval): development of exploration algorithms so that they can operate simultaneously (Real-time) and in interactive systems.
- Distributed IR: Providing a ranked list of search results based on information retrieval from multiple databases

One of the software designed by the Management Information Retrieval Center and which uses various methods to retrieve information related to users' information needs is called, INQUERY. Perhaps this program can be considered one of the most important developed programs that have used the capabilities of intelligent and expert systems objectively and practically in the information retrieval process. This program uses natural language models, Boolean logic, approximation, user feedback regarding the relevance or irrelevance of the retrieved information, and modification of the search results, and ranks the retrieved records based on the probability of relevance to the information needs of managers.

This program can automatically define search terms based on managers' feedback so that other related records can be retrieved. Long documents are retrieved both based on their internal content and the most relevant phrase.[13] Examining the features and capabilities of this program is important in the sense that it seems that it has tried to apply the results of much theoretical research of this center and other research in the field. Expert and intelligent systems in effective and efficient information retrieval should be practically implemented in this software.

Other applications in information retrieval

A . Intelligent agents are software capable of intelligently retrieving data from multiple sources or databases without human intervention. Lancaster and Warner defined the term intelligent agents as tools capable of performing various tasks in the field of information retrieval on the Internet and other management databases [14,15]. Some search engines also claim to use intelligent factors in ranking their search results.

B. Management intermediaries. The design of management interfaces in the information system makes it possible to be used by a wider range of users. Such systems are often designed for ease of information retrieval and are able to adapt themselves according to the search skills and knowledge of managers. In other words, managers have less need to have specialized skills and knowledge in the field of advanced search and related information retrieval. The ability to communicate with the user through a simple search interface, flexibility to adapt to users' information search skills, the ability to change the search interface according to users' needs, helping the user in choosing a database, and facilitating the

process of ordering retrieved records are among the most important features of intelligent interfaces they are counted as.

Conclusion

Although there are many efforts related to the use of expert systems and commercial management in information retrieval, the study of various discussions in related literature shows that a large amount of this research has led to theoretical studies or the design of expert systems in experimental and non-experimental studies. Lancaster and Warner, one of the most important reasons for the lack of development of expert systems in business management activities that include information retrieval, is costly to design such systems as well as their complexity. It seems that the idea that software and management software has little cost to perform some management activities, has misled many managers of libraries and other researchers. Contrary to the existing notion, creating a knowledge base associated with management activities would require a relatively long time.

Furthermore, continuous updating of these systems is very expensive. The two researchers in their book emphasize that the intelligent and expert systems that have been developed in the field of management activities are not more effective than those developed in other areas. In other words, in order to design intelligent and intelligent systems in management activities, it is necessary to spend a lot of time and time and this possibility is not available either in many research projects or is challenged. [16,17]

Another very important point that may have influenced the use of expert and intelligent systems in retrieving management information is related to the nature of such systems. Determining the relationship itself is an issue that there are still discussions and different points of view about it even in traditional systems. It is accepted by everyone that research has been done and is being done in the field of designing and developing information retrieval systems, to facilitate and improve the process of accessing documents related to the information needs of managers[18,19]. Even if an intelligent or expert system in its best conditions can retrieve relevant documents based on algorithmic and discovery logic or a combination of both[20], this does not necessarily mean that it is consistent with the information needs of managers. The subjective nature of the concept of relevance and the need for information has caused that, despite extensive research in this field, the problem of meeting the real needs of managers is still one of the most important issues in the field of management.

The design of such issues can make the role of expert and intelligent systems an efficient intermediary between the information needs of managers and related documents in a database with ambiguities and emphasize their role as an "assistive tool" for information recovery. Perhaps managers and their real information needs are the only key element in the

design of expert and intelligent recovery systems, which should be studied more on its various aspects. Maybe that's why "getting feedback on how to relate" is focused.

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