

EXPERT SYSTEMS IN A COMMERCIAL ENVIRONMENT

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Abstract

One of the current terms in decision support methodologies is Artificial Intelligence (AI). The search for AI, particularly in potential business applications, targets techniques which collectively result in expert systems. The purpose of this article is to identify an expert system and explain how this rapidly emerging technology can be used in a commercial environment.

INTRODUCTION

As our environment grows increasingly complex, our reliance on information also expands. Norbert Wiener, often referred to as the father of cybernetics, began the search of AI with the general purpose computers (1). The first step was to search for generally accepted principles on which to base the systems (computers). This search evolved into one of discovering what is referred to as "minimal self-organizing systems (2)." The next step in the search was to try to duplicate human thinking processes in the systems. The problem with this approach was that methods which worked well on easy problems did not work effectively with more difficult ones. Finally, the search has turned toward AI and expert systems.

AI is a branch of computer science involving the study of programming computers to perform functions considered to be high-level human activities. Examples of such activities include reasoning, seeing, hearing, planning, and manipulation. AI involves the programming of computers with traits normally associated with human intelligence or with getting a computing system (i.e., hardware and software) to

perform acts we think of as the province of humans. This attempt has been approached without prejudice toward making the system simple, biological or humanoid. The field of AI is associated with different human activities that are imitated by machine.

The study of expert systems is so new that the experts themselves are still divided about its definition. Actually, no clear cut distinction exists between expert systems and AI. When discussing expert systems, one must think in terms of AI because an expert system is a computer program with built-in knowledge and, consequently, capabilities that enable it to operate on the level of a human expert.

Currently, computers are used as large data bases which store and process data as well as aid in the decision-making process. Decision Support System (DSS) have been created and, through the use of mathematical models which reflect a given situation, perform basic decision making. "A DSS is a set of computer-based tools used by a manager in connection with his or her problem-solving and decision-making duties. The manager, of course, makes

found. Thus, the purpose of the development of expert systems is to create systems which can solve problems effectively and efficiently and to assist professionals in the tasks of diagnosis, discovery, and exploration. In other words, the aim of the expert system is to be able to solve, explain, learn, and determine the relevance of both symbolic and arithmetic problems.

This article will identify, discuss, and evaluate the following areas: the goals and limitations of expert systems into the commercial area; the reasons for bringing expert systems into the commercial area; important considerations affecting the decisions to develop expert systems; and brief predictions about the future of expert systems.

GOALS AND LIMITATIONS

An expert system employs a set of decision rules used by professionals in a discipline. An inference rule is a logical rule such as 'if this is true, this is also true' or 'when this condition exists take this route' etc. An expert system performs logical analysis of a specialized, limited body of information to reach suggestions, or recommendations, often through interaction with a human user (manager), until a viable solution is found. Thus, the primary function of expert systems is to solve problems.

It is the goal in the development of the expert system to create programs which go beyond the limits of traditional programming. In addition to having an expert system to solve problems, it allows managers to learn and explain the results of the problem-solving process since expert systems are usually built to explain the lines of reasoning that led to their decisions. Expert systems explanation capabilities range from basic back-tracking through a problem trail of logic to a multi-level explanation that describes how and why the system reached a particular conclu-

sion. This is a very useful feature for an organization because it can aid managers in making decisions and learning the reasons why certain paths (decisions) were selected while others were rejected.

COMMERCIAL AREA

Traditionally, numerical problems were the only type of problems that could be solved. Symbolic processing as well as numeric processing are now the focus of expert systems. Symbolic processing involves actions whereby symbols (such as text) aid in the interpretation of problems. The purpose of symbolic processing is to give relevance to solutions to evoke some predetermined behavior. For an expert system to be useful in the commercial environment, it should be able to process symbolic and numerical programming as well as make intelligent decisions without having all the available facts. Well-structured problems such as payroll processing, that break down into algorithms, are useless when uncertainty is present. If the expert system can be programmed to accurately account for degrees of uncertainty, it then becomes a useful commercial tool.

Rudimentary learning abilities are incorporated in some systems; however, various problems with expert systems have not yet been solved. For example, expert systems cannot handle inconsistent knowledge, perform functions that involves common sense, assign relevance to a problem, or determine the limits of its own expertise. Also, there is a limited explanation of the reasoning by the systems, making it difficult to apply real-life problems that arise on the borders of the knowledge domains (4). Despite these limitations, expert systems have been create by using knowledge and available problem-solving techniques that can diagnose diseases, locate mineral hardware and aid mechanics in troubleshooting locomotives.

Information systems are becoming an increasingly important part of today's businesses. Expert systems allow conventional information systems to grow to include the ability to accept new tasks and to leverage old ones. Expert systems are evolving to meet the needs of managers who want to understand their profession and try to exercise control over the processes that affect them. By setting up rules for problems and using algorithms, managers can increase their efficiency thorough the use of these systems. Since the expert systems can solve quantitative, routine, and repetitive problems as well as those involving heuristics, trial-and-error approach, and intuition, efficiency of the manager can increase and growth of the organization can be readily accommodated.

Most experts (programmers) seem to agree that the high level languages such as PROLOG and LISP do not work well in the commercial environment. To succeed in the commercial environment, expert systems must have the capability to integrate into existing software and hardware. A new C language code may be the solution that programmers are seeking because of its capability to integrate easily with existing systems.

While the use of expert systems are many, the corporate arena will benefit most from their development. "Expert systems are for solving problems where people have experience that cannot be modeled quantitatively. They are not for problems people cannot solve or problems that can be solved by mathematical models (5)." While expert systems are similar to conventional DSS, they differ mainly in the nature of the contents of the data base, the collection of models and in the necessity of a knowledge engineer as a crucial element for developing the system. "Expert systems operate particularly well where thinking is mostly reasoning, not calculating (which is what is performed in a DSS)-and that means most of the

senior manager's work (4)". Expert systems will accomplish many of the tasks previously accomplished by the organization's managers. This feat will be accomplished through utilization of the accumulated knowledge gained from human experts thus facilitating the decision being made based on information so provided.

Human experts have acquired their expertise not only from knowledge found in lectures and technical journals but also from experience, i.e., repeating activities, failing, succeeding, and getting a feel for a problem. They, therefore, build up a repertory of working rules of thumb which, combined with book knowledge, make them experts in a certain domain. Development of expert systems should generally phase out the need for human experts in many areas.

R1 is an example of an expert system currently in use. Digital Equipment Corporation (DEC) designed the R1 configure for VAX computer system. "Customer orders for a VAX system come in a wide variety of requirements (the system has more than four hundred components, with an average of eight properties per component that the configure must know) (4)." Details of a customer order for computer equipment along with diagrams displaying spatial relations among ordered components are entered into R1. The system breaks the problem of configuring hardware into components and suggests a solution in three to five minutes instead of the half-hour to three days an individual may require to configure that same solution.

The point to be stressed in describing the use of expert systems in the commercial environment is that the word expert has to be handled with care. People seem to want to put a special connotation on the use of expert systems. The term seems to imply that people can delegate control of decision making responsibility to a

computer and some sophisticated software package. This simply is not so. The first requirement in dealing with expert systems in a commercial environment is to establish a realistic perspective (3).

CONSIDERATION

Before developing an expert system, a firm needs to evaluate several considerations. First, the question of whether or not a new system is needed should be addressed. Usually, expert systems are needed when organization experts are inadequate in areas that consume large amounts of time (5). Next, it must be concluded that an expert system will provide the best solution to the problem being studied or considered. Perhaps a minor change in software or a small adjustment in the organization structure is the answer. However, if the problem is more heuristic in nature and an expert system is needed, the benefits sought by the proposed system need to be specified. How the system will be used, by whom, and whether the findings made by the expert system will be accepted by the organization should be established. Finally, after the need for the system is apparent, the advice from an expert within the company has to be taken into account. This advice will involve questions such as how complex the system should be and whether it is feasible to develop it internally in the organization.

PREDICTION

Expert system and artificial intelligence are in the infancy stage of development and use. The future seems to indicate an increased reliance on expert systems over the next three to five years. Experts systems will benefit the business world more than any other field. The use of expert systems increases the compatibility of businesses by increasing their efficiency and

allowing them to expand along with their information capacities. Of all the high level languages, C language will probably be the language that works best in the commercial sector because of its power and compatibility with existing systems.

Prudent use of expert systems will provide organizations with several competitive advantages. It will allow human experts to handle more challenging assignments by allowing the systems to perform routine tasks. Expert systems have been proven very useful as educational devices since they explain lines of reasoning. "Modular and rule based expert systems are light on maintenance costs when they are compared to software packages of the past (6)." Users will waste less time trying to understand an expert system since, unlike conventional systems, it has the capabilities to explain itself.

CONCLUSION

The expert system is a new problemsolving tool. But, like most tools, it is not applicable to all domains of knowledge. However, the expert system is applicable to many of commercial applications which present the most difficulty in solving problems. These problems can't be solved by a standard approach, but require for their solution based upon experience (8, p. 17). As an intellectual amplifier the expert system can be a tremendous force for change in the commercial environment. The expert system can change the nature of intellectual work more drastically than any invention preceding it. It can change the nature of management, research, marketing and distribution, software, education, and many other activities.

Different assumptions have been made involving the use of expert systems. It is true that certain aspects of decision making can be delegated for automatic execution by an expert sys-

tem. It is also true that expert systems can and do select courses of action on the basis of processing results. But it is NOT true that an expert system can relieve managers of any responsibilities for the consequences of

decisions. A computer cannot accept authority nor can a machine exercise responsibility. Therefore, an expert system remains a tool for responsible, sophisticated managers faced with decisions involving multiple, complex facets (3, p. 187).

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