Research Aspects of Expert System

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Abstract

An expert system is a computer program that simulates the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field. It is a program that emulates the interaction a user might have with a human expert to solve a problem. The end user provides input by selecting one or more answers from a list or by entering data. An Expert System is a problem solving and decision making system based on knowledge of its task and logical rules or procedures for using knowledge. Both the knowledge and the logic are obtained from the experience of a specialist in the area. This paper introduces introduction, structure, new tools and applications of expert system. In this paper advantages and limitations of expert system and the various research approaches in expert systems are discussed. This paper also outlined current research trends which are going on expert system and why the various Industries are planning to use expert system.

1. Introduction

An Artificial Intelligence System created to solve problems in a particular domain is called an Expert System. An expert system is a computer program that simulates the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field. An expert system may be viewed as a computer simulation of a human expert. Expert systems are an emerging technology with many areas for potential applications. Past applications range from MYCIN, used in the medical field to diagnose infectious blood diseases, to XCON, used to configure computer systems. Expert systems are typically very domain specific. For example, a diagnostic expert system for troubleshooting computers must actually perform all the necessary data manipulation as a human expert would. The developer of such a system must limit his or her scope of the system to just what is needed to solve the target problem. Special tools or programming languages are often needed to accomplish the specific objectives of the system.

2. Expert System Structure

Complex decisions involve intricate combination of factual and heuristic knowledge. In order for the computer to be able to retrieve and effectively use heuristic knowledge, the knowledge must be organized in an easily accessible format that distinguishes among data, knowledge, and control structures. For this reason, expert systems are organized in three distinct levels:

1. Knowledge base consists of problem-solving rules, procedures, and intrinsic data relevant to the problem domain.
2. Working memory refers to task-specific data for the problem under consideration.
3. Inference engine is a generic control mechanism that applies the axiomatic knowledge in the knowledge base to the task-specific data to arrive at some solution or conclusion.

These three pieces may very well come from different sources. The inference engine, such as VP-Expert, may come from a commercial vendor. The knowledge base may be a specific diagnostic knowledge base compiled by a consulting firm, and the problem data may be supplied by the end user. A knowledge base is the nucleus of the expert system structure. A knowledge base is not a data base. The traditional data base environment deals with data that have a static relationship between the elements in the problem domain. A knowledge base is created by knowledge engineers, who translate the knowledge of real human experts into rules and strategies. These rules and strategies can change depending on the prevailing problem scenario. The knowledge base provides the expert system with the capability to recommend directions for user inquiry. The system also instigates further investigation into areas that may be important to a certain line of reasoning but not apparent to the user. The knowledge base constitutes the problem-solving rules, facts, or intuition that a human expert might use in solving problems in a given problem domain. The knowledge base is usually stored in terms of if–then rules. The working memory represents relevant data for the current problem being solved. The inference engine is the control mechanism that organizes the problem data and searches through the knowledge base for applicable rules. With the increasing popularity of expert systems, many commercial inference engines are coming onto the market.

3. Uses of Expert Systems

1. Experts are not always available. An expert system can be used anywhere, any time.
2. Human experts are not 100% reliable or consistent
3. Experts may not be good at explaining decisions
4. Cost effective
5. ES are often faster than human experts
6. Provide a high potential payoff or significantly reduced downside risk
7. Provide Multiple expertise

8. Provide expertise needed at a number of locations at the same time.
9. Provide expertise that is expensive or rare
10. ES are easy to develop and modify

3.1 ES Applications

1. PUFF: Medical system for diagnosis of respiratory conditions.
2. PROSPECTOR: Used by geologists to identify sites for drilling or mining.
3. MYCIN: Medical system for diagnosing blood disorders. First used in 1979.
4. DESIGN ADVISOR: Gives advice to designers of processor chips.
5. DENDRAL: Used to identify the structure of chemical compounds.
6. LITHIAN: Gives advice to archaeologists examining stone tools.
7. Expert Systems used in Education and used for Learning Internet.

3.2 ES used in India

1. National Institute of Agricultural Extension Management in Gujrat has developed an expert system to diagnose pests and diseases for rice crop.
2. TDP Technologies Pvt. Ltd. In Chennai is using MYCIN technique for diagnosing blood disorders.
3. Center for Informatics Research and Advancement, Kerala has prepared an Expert System called AGREX to help the Agricultural field personnel give timely and correct advice to the farmers.
4. Tata Memorial Hospital in Mumbai is using PUFF for diagnosis of respiratory conditions.

4. Problems with Expert Systems

1. Limited domain
2. Systems are not always up to date, and don't learn
3. No "common sense"
4. Experts needed to setup and maintain system
5. lack of trust
6. Possibility of error

7. Cannot refine own knowledge base
8. May have high development cost

5. New Tool used in ES

ES/KERNEL2, is the **Latest Japanese tools,** the new version of the current best-selling tool, is geared to the development of large-scale applications. It gives the application developers choice in the use of reasoning methods: rule-based reasoning, object-oriented reasoning, and assumption-based reasoning can all be used within a single expert system. Associated with each reasoning method is a knowledge representation scheme best suited to it.

5.1 Characteristics of ES/KERNEL2

It provides graphic, as well as multi-media, tools for developing business applications. It's very easy to use this tool and this tool can be configured according to our requirements. It helps knowledge engineers in modifying the knowledge base. As it's the latest tool, so further research is being going on it.

6. Research Aspects of Expert System

6.1 Distributed Robotics

In China, recently people use Distributed Robotics to transfer weather condition from one region to other. As this is distributed robotics system, so they use multiple robots. These robots are trained by experts. One robot learned from environment. Second robot learned from the first robot using various ES techniques. The time for the objective to be completed is measured at each observation. Three trails of such robots have been made successfully.

6.1.1 Working of Distributed Robotics

Input from environment

-Cameras

-Sensors

Communication

-To other robots

Processing

- Weather forecasting

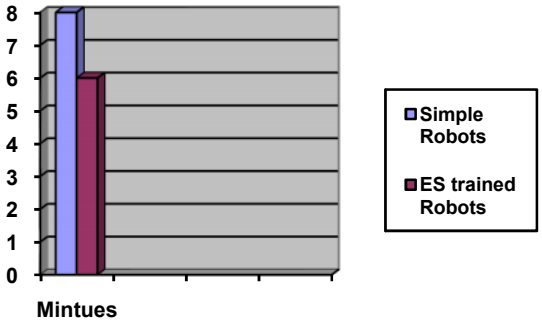

Chart1: Robots/ES trained Robots

From this, it is clear that simple robots take 8 minutes to complete a work while Expert system trained robots will take only 6 minutes to perform same work.

6.2 Learning Agents

Building an agent for a specific application consists in customizing the shell for that application and in developing the knowledge base. The learning engine facilitates the building of the knowledge base by subject matter experts and knowledge engineers. Develop a capability that will allow subject matter experts and typical computer users to build and maintain knowledge bases and agents, as easily as they use .personal computers for text processing.

This research aims at changing the way future knowledge-based agents will be built, from being programmed by computer scientists and knowledge engineers, to being taught by subject matter experts and typical computer users. Agents teach through examples and explanations, in a way that is similar to how the expert would teach a student.

6.3 Business Structure with ES

Japan and Australia plan to use expert system because without expert system they have to face many problems, such as:

- Slow Decision
- High cost of equipments
- High cost in hiring of locals and other Japanese
- Cultural integration with local employees to work in a flawless way
- In Building the next set of large, deep relationships- means improve customer relationship**.**

One of the fastest growing areas of information technology, artificial intelligence uses the computer to simulate some of the characteristics of human thought. The term artificial intelligence (AI) means the simulation of human thought process in order to select the best mode of behavior, e. g. taking a decision or responding to a situation. Expert systems are a major application of AI. They act like a human "expert" in analyzing unstructured situations. Expert systems are also called "knowledge-based" systems since they are built on a framework of known facts and responses to situations. It is believed that we are moving rapidly from industrial-based society to an information based one. The application of computer technology to management information and decision support systems has certainly had an effect on how managers perform their tasks

And on how organizations behave Information systems are seen as a strategic resource within the organization: that is, they have an important impact on key operations which determine the livelihood of the organization. When the organization is a small, simple set-up the need for sophisticated information can be virtually non-existent. In a small firm with a manager, a small number of staff and customers, that manager will probably know every aspect of the business in detail and will probably keep his/her own records of useful information in his/her informal information system. The situation becomes trickier if within this one business there are two different types of activity. The manager might begin to feel the need for some formal system for managing information in order to allow him/her to priorities the use of time and concentrate on the important indicators of business success.

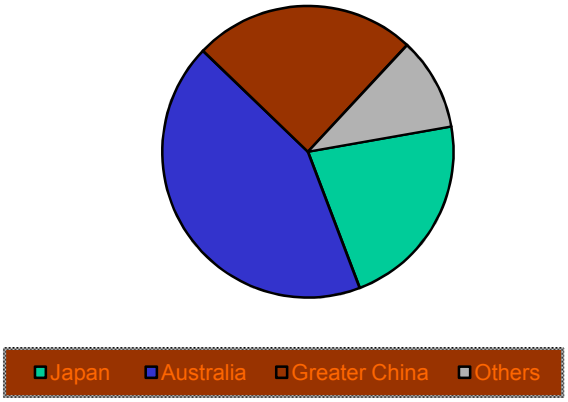

Chart2: Latest survey on Expert System

A great number of small and middle enterprises (SME) seemed to lag technologically from the bigger firms and might be excluded from the e-markets. This may have a negative influence on their future development. The managers of SME probably think that the business processes in their firms are not such complicated and do not require the use of IT. It is obvious that the need for management information increases with the complexity of the organization, the complexity of the tasks carried out and the rate of change in the environment of the organization. Companies where responsibilities are clearly defined and understood will find it much easier to set up effective information systems, as will those where the structure and culture are not in conflict. By structure is meant the way in which an organization is physically arranged in departments and/or locations. Culture is a term for the set of traditional and habitual ways of thinking, feeling, reacting to opportunities and problems that confront an organization. Both structure and culture might influence the way information flows through the organization. Computers have been used in the clothing industry since the earliest introduction of IT. In those days only the very large tailoring companies had the resource to take up this technology. They used them mainly for business data processing.

During this decade, the textile industry has progressively taken up computerization. The application of computers is wide ranging covering almost all activities necessary to run a textile business: accounting and transaction processing, sales and marketing, production planning, computer-aided management, real-time management etc. Over time the nature of computer systems in their implementation has taken several forms: standalone applications based on one computer; an integrated centralized system where one large computer handles a range of applications; applications catered for by having ones data processing distributed over a network of computers.

A lot of clothing companies continued to invest not only in very latest production technology, but also in design technology and computer systems. They use computers complete with Intranet so that a lot of people working on PC's throughout the group could access and work with data on the main computer. MIS in clothing companies should include the control of the stock, processing of each individual order, accounting etc. Most of the tailoring enterprises have a web site and in this way e-commerce is widening. E-commerce offers a unique opportunity for economic growth, to improve industry's competitiveness and to stimulate investment in innovation and the creation of new jobs. Commercial communications are an essential part of

most electronic commerce services. Electronic commerce is global and requires increased international coordination. Its implementation opens not only new markets, but it also changes the way in which business is made. E-commerce over the World Wide Web is growing at an astronomical pace. Many of the top e-commerce sites report revenue growth exceeding 100 percent per year. Electronic commerce will allow the companies of tailoring industry to compete on the world's scene, regardless their geographic situation. Europe is late in developing and implementing of the modern IT. So, by using the ES productivity and relationship with the customer increases which is the main principle of business.

6.4 High Performance Computing Research Center

This center is currently developing Expert systems that are able to access intramuscular fat in cows and pigs. Amount of fat depends on breed, food, placement of the animals, weather, and many other factors. Animal scientists know what they want, but they cannot find the correlation between these factors. So, developing the neural network, or fuzzy logic or expert system to guide decision during the raising of the animals will help to achieve the quality and cut down cost. This institute also currently start to develop a Knowledge Base that Support Detection and Diagnosis and do Research in Mammography. This will be done by using Expert system, neural network that will firstly do identification and modeling and then will consider other various factors together with mammogram results to give accurate result and helps us in making decision.

6.5 Future Work

Research is being going on to developing such an expert system, who can understand emotions of people, can create new innovations itself and can judge intelligence of person. And system that must be able to understand from environment and to make such an expert system those are able to maintain itself and able to update itself. Today's expert systems deal with domains of narrow specialization. For expert systems to perform competently over a broad range of tasks, they will have to be given very much more knowledge. The next generation of expert systems will require large knowledge bases. And research is being going on it.

Conclusion

Expert systems or knowledge based systems are used to represent and process in a format that is suitable for computers but still understandable by humans. ES can be cheaper, faster, more accessible, and more reliable than humans Intelligence. A large number of expert systems are in real use and quite a few even being sold for individual use. In the future one is likely to see more expert systems packaged with domain knowledge being sold. Further, these systems are also likely to carry out specialized tasks as parts of much larger software systems. With ES productivity and relationship with the customer increases which is a main principle of business. ES agents teach the student in same way as a teacher teaches to them.

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