International Journal of Advanced Research in Engineering and Applied Sciences
ISSN: 2278-6252

AN INTRODUCTION TO EXPERT SYSTEMS

Hamid Shafie*

Amin Samimi*

Abstract: *To describe the export in one sentence, we should say that generally these systems are programs which are able to reason the specific matters, like human being. For reasoning, these systems use the particular logic patterns which similar to the act human being are done during the solution of a problem. In fact, as like human being thinks to solve a problem, the expert systems to do this, use the patterns and methods which are specified by human being.*

Therefore, it can be said these systems think somewhat like human being because they use the human logic.

Keywords: *Expert systems, knowledge base, Interface engine, fuzzy logic*

*Department of Computer Engineering, Behbahan Branch, Islamic Azad University, Behbahan, Iran

1. INTRODUCTION

A Trans-expert system is an intelligent computer program that uses knowledge and inference procedures to solve problems that are difficult enough to require human intelligence to solve them. In other words, Trans-expert systems are applicable computer programs which include some non-algorithmic skills for solving certain types of problems [1].

Figure 1 shows the basic concept of a knowledge-based Trans-expert system. The user provides the trans-expert system with facts (events) or other information and in response will receive experience, skill, and advice wisely and in a word, he will take expertise. In terms of internal structure, an expert system consists of two main parts. The first part is the knowledge base. This base contains a knowledge that helps the second part which is the inference engine to conclude. These results are the answers of the user's questions provided by the Trans-expert system. Efficient knowledge-based systems are designed so that they can act as an intelligent assistant for experts. These intelligent assistants are designed by the technology of Trans-expert systems due to the possibility of expanding them in future. The more knowledge is added to an intelligent assistant system, the more the system will act like an expert. Developing an intelligent assistant system can release more time of an expert by speeding up the problem-solving processes.

2. THE STRUCTURE OF A TRANS-EXPERT SYSTEM

Trans-expert systems are one of the major insights gained from the early works in problem-solving issues of specific knowledge with a focus on the associated field [2]. For example, a physician is not only effective in diagnosis because he has an innate general problem solving. Since he has a lot of information in the medical field they prove to be helpful. Intelligent systems are made for the acquisition of this knowledge from an expert and encoding it into a form that a computer may use for similar problems. This reliance on expert background knowledge for problem-solving methods systems is considered as an important feature of the Trans-expert systems. The followings are the main constituents of a Trans-expert system:

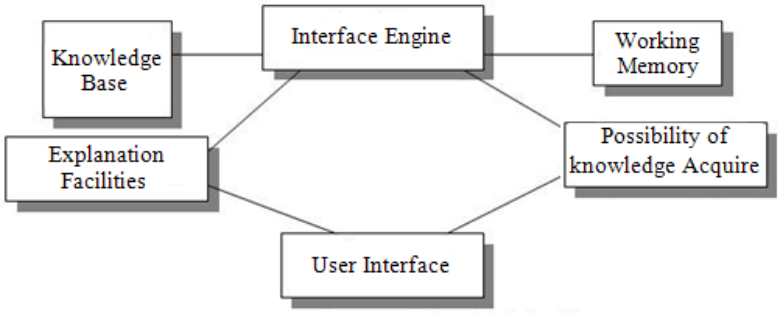

Figure 1: The main constituents of an expert system

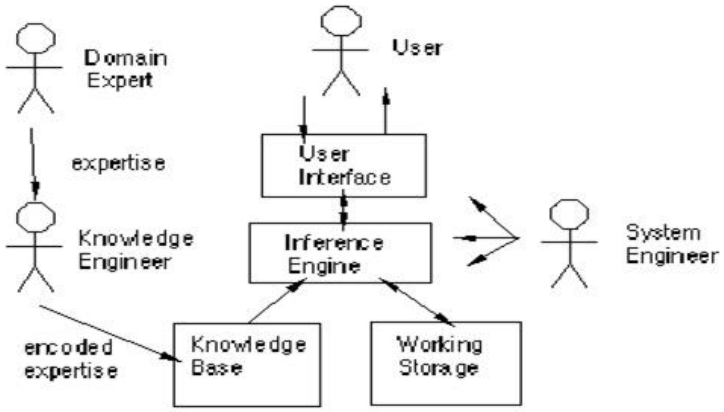

Figure 2: Schematic view main constituents of an expert system

2.1. Knowledge Base

It is where the expert local knowledge is stored and coded in an understandable way for the system. A person who converts the expert knowledge to codes and then enters them to the knowledge base is called 'knowledge engineer'. Generally, knowledge is stored in knowledge base in the form of conditional statements and rules such as the following statements:

'If the light is red then be stopped'

Whenever there is the fact that the light is red, then the fact will be consistent with the pattern 'the light is red'. In this case, the rule is satisfied and the pattern or action of this rule is performed as "be stopped".

2.2. Knowledge Acquisition Facilities

Knowledge acquisition includes the entire processes in which knowledge is converted to a usable form in an intended Trans-expert system. The first task of a knowledge engineer is familiarity with the range of the intended applications and an understanding of the basic and theoretical concepts. This information can be found in books, references, documentation, and etc. But since these knowledge resources are quickly outdated (not

updated) an interview with the expert people is required. Other knowledge acquisition techniques include observation, case studies, protocol analysis, role-playing, web browsing and etc.

2.3. Inference Engine

Two methods of inference called progressive and regressive are applied as problem-solving strategies in Trans-expert systems. In progressive inference, the system starts deducting from facts or realities to reach a conclusion originating from these facts. For example, before leaving home if you see it is raining (fact), you would take an umbrella; therefore, in regressive inference the deductions are made in reverse. So they try to reach the facts and the realities of a hypothesis through the hypothesis or the potential conclusion that is to be proved. Depending on the system design, the inference engine can be either progressive or regressive. The inference engine selection depends on the type of the problem. Performing regressive inference in diagnostic problems is more recommended, while in issues of forecasting, monitoring, and control, it is much better to use a progressive approach.

2.4. Explanation Facilities

Explanation facilities are used to illustrate the processes of inference for a specific problem with a particular fact in the Trans-expert system to a language that can be understood by the user. One of the benefits of these facilities is that by observing the inference processes, the user will have more confidence to the decision taken by the system. And he will be ensured of the knowledge being validly entered into the knowledge base.

2.5. User Interface

Naturally, user interface of a Trans-expert system should be highly transactional so that the information exchange structure is performed in the form of a conversation between an applicant and an expert. User interface of a Trans-expert system not only enables the user to answer questions but also will allow the user to hang the operation of the system with questions about the explanations of the questions. For example, if the user of a Trans-expert system is told to have Meningitis, the user might want to know how the system has reached the conclusion.

3. THE USE OF FUZZY LOGIC IN TRANS-EXPERT SYSTEMS

Another important issue regarding Trans-expert systems is their associations with the other branches of artificial intelligence [3]. To clarify the point, some Trans-expert systems use

Fuzzy Logic. In defuzzification logic only two values of true or false exist. Such logic cannot be completed because an understanding of human decision making process in many cases is not quite conclusive; depending on the time and place, they are partly true or partly false. During 1920s and 1930s, Jan Lukasiewicz, a Polish philosopher, proposed a logic that could be worth more than two values of 0 and 1, or true and false [4]. Then, professor Lotifizade indicated that Lukasiewicz logic can be proposed as "degree of correctness". This means instead of saying: "This logic is true or false?", we may say: “how right or wrong the logic is?".

4. THE ADVANTAGES AND LIMITATIONS OF USING TRANS-EXPERT SYSTEMS

Advantages:

- ✓ Saving costs
- ✓ Better, more accurate, and in many cases specialized decisions.
- ✓ The use of Trans-expert systems leads to saving in companies.
- ✓ In decision making (complicated situations) with the utilization of such systems, better decisions can be adopted.

Limitations:

- ✓ These systems have no feelings or senses about what they do.
- ✓ These trans-expert systems cannot generalize their expertise to wider ranges because they are only designed for one purpose.
- ✓ Knowledge base of these systems has been derived from the knowledge of the experts in that domain and hence is limited.
- ✓ In case of unforeseen circumstances, they cannot properly analyze the new situation.

5. APPLICATION OF TRANS-EXPERT SYSTEMS

Trans-expert systems can actually be used in all fields of knowledge. Some of these systems are designed as a research tool, while other systems are useful for commercial and industrial applications [5]. Some of these applications are Observable in Table 1.

Table 1: Different types of expert system

Some examples of expert	Public sphere
Configuration (shaping)	Proper assembly of a suitable model
recognition	The inference problem based on the evidence
learning	Smart training as a student questions as to why, how, what to ask. Just as a man is training.
Interpretation	Description of information available and observed
display	Comparing the information with the information expected to judge the performance of
Planning	Recommend solutions to achieve an optimal performance
Prediction	Predict the outcome of a particular situation
Restoration	Prescribed way of dealing with a problem
Control	Setting process, which may be interpreted as diagnosis, screening, planning, forecasting and repair needs

In the following table is shown several examples of expert systems in medical field.

Table 2: Expert Systems in Medicine

Type of operation	Name of expert system
Diagnosis of Lung Disease	PUFF
Monitoring of patients needing intensive care	VM
Detection of acid and electrolytes	ABEL
Detection of blood diseases	AI/RHEUM
Diseases related to Internal Medicine	CADUCEUS
Surveillance and analysis of health	ANNA
Diagnosis and treatment of depression	BLUE BOX
Diagnosis and treatment of microbial diseases.	MYCIN
Chemotherapy treatment and management of patients	ONCOCIN
Education in anesthesia management	ATTENDING
Education in Microbial Disease	GUIDON

6. CONCLUSION

Knowledge in Trans-expert systems can include experience or knowledge which is available through books, magazines, and scientists. Terms of Trans-expert systems like knowledge-based systems or knowledge-based Trans-expert systems are used interchangeably. Most

people use the Trans-expert system term since it is short. Meanwhile, the Trans-expert system may not have any experience and skills and just includes a general knowledge.

REFERENCES

[1] Stylianou, A. C., Madey, G. R. and Smith, R. D. (1992). "*Selection criteria for expert system shells: A socio-technical framework*". Communications of the ACM, 35, 10, 30 – 48

[2] Buchanan, B. G. & Shortliffe, E. S. (1994). "*Rule-based expert systems: The MYCIN experiments of the Stanford Heuristic Programming Project*". Reading, MA: Addison-Wesley.

[3] Kahn, G. (1988). "*MORE: From observing knowledge engineers to automating knowledge acquisition"*. In S. Marcus (Ed.) Automating Knowledge Acquisition for Expert Systems, 7 - 36. Boston: Kluwer Academic Publishers.

[4] Appel, M. V. & Scopp, T. S. (1987). "Automated *industry and occupational coding*". Paper presented at Development of Statistical Tools Seminar on Development of Statistical Expert Systems, Luxembourg.

[5] Hauser, R. D. & Hebert, F. J. (2002, Winter). "*Managerial issues in expert system implementation"*. SAM Advanced Management Journal, 10 – 15.