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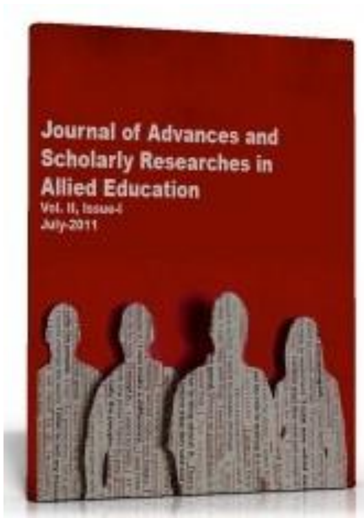
Study on An expert system as a software system



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AN EXPERT SYSTEM IS A SOFTWARE SYSTEM

It attempts to reproduce the performance of one or more human experts, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence. A wide variety of methods can be used to simulate the performance of the expert however common to most or all are 1) the creation of a so-called "knowledge base" which uses some knowledge representation formalism to capture the subject matter experts (SME) knowledge and 2) a process of gathering that knowledge from the SME and codifying it according to the formalism, which is called knowledge engineering. Expert systems may or may not have learning components but a third common element is that once the system is developed it is proven by being placed in the same real world problem solving situation as the human SME, typically as an aid to human workers or a supplement to some information system.

Artificial intelligence (AI) is both the intelligence of machines and the branch of computer science which aims to create it.

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Major AI textbooks define artificial intelligence as "the study and design of intelligent agents," where an intelligent agent is a system that perceives its environment and takes actions which maximize its chances of success. John McCarthy, who coined the term in 1956, defines it as "the science and engineering of making intelligent machines."

Among the traits that researchers hope machines will exhibit are reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects. General intelligence (or "strong AI") has not yet been achieved and is a long-term goal of AI research.

AI research uses tools and insights from many fields, including computer science, psychology, philosophy, neuroscience, cognitive science, linguistics, ontology, operations research, economics, control theory, probability, optimization and logic. AI research also overlaps with tasks such as robotics, control systems, scheduling, data mining, logistics, speech recognition, facial recognition and many others.

As a premiere application of computing and artificial intelligence, the topic of expert systems has many points of contact with general systems theory, operations research, business process reengineering and various topics in applied mathematics and management science.

- ART - An early general-purpose programming language used in the development of expert systems
- CADUCEUS (expert system) - Blood-borne infectious bacteria
- CLIPS - Programming language used in the development of expert systems
- Drools - An open source offering from JBOSS labs
- Dendral - Analysis of mass spectra
- Dipmeter Advisor - Analysis of data gathered during oil exploration

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- Jess - Java Expert System Shell. A CLIPS engine implemented in Java used in the development of expert systems
- KnowledgeBench – expert system for building new product development applications
- MQL 4 - MetaQuotes Language 4, a customized language for financial strategy programming
- Mycin - Diagnose infectious blood diseases and recommend antibiotics (by Stanford University)
- NEXPERT - A mission-critical Operational Support Systems framework with rules, policies, object modeling, and adapters for Network Operations Center automation
- NEXPERT Object - An early general-purpose commercial backwards-chaining inference engine used in the development of expert systems
- Prolog - Programming language used in the development of expert systems
- Forth - Programming language used in the development of expert systems
- R1/Xcon - Order processing
- SHINE Real-time Expert System - Spacecraft Health INference Engine
- STD Wizard - Expert system for recommending medical screening tests
- PyKe - Pyke is a knowledge-based inference engine (expert system)

THE STUDY OF EXPERT SYSTEMS

Knowledge representation is an issue that arises in both cognitive science and artificial intelligence. In cognitive science, it is concerned with how people store and process information. In artificial intelligence (AI) the primary aim is to store knowledge so that programs can process it and achieve the verisimilitude of human intelligence. AI researchers have borrowed representation

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theories from cognitive science. Thus there are representation techniques such as frames, rules and semantic networks which have originated from theories of human information processing. Since knowledge is used to achieve intelligent behavior, the fundamental goal of knowledge representation is to represent knowledge in a manner as to facilitate inferencing i.e. drawing conclusions from knowledge.

KNOWLEDGE ENGINEER

Knowledge engineers are concerned with the representation chosen for the expert's knowledge declarations and with the inference engine used to process that knowledge. He / she can use the knowledge acquisition component of the expert system to input the several characteristics known to be appropriate to a good inference technique, including:

- A good inference technique is independent of the problem domain.
- In order to realize the benefits of explanation, knowledge transparency, and reusability of the programs in a new problem domain, the inference engine must not contain domain specific expertise.
- Inference techniques may be specific to a particular task, such as diagnosis of hardware configuration. Other techniques may be committed only to a particular processing technique.
- Inference techniques are always specific to the knowledge structures.
- Successful examples of rule processing techniques are forward chaining and backward chaining.

CHAINING

There are two main methods of reasoning when using inference rules: backward chaining and forward chaining.

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Forward chaining starts with the data available and uses the inference rules to conclude more data until a desired goal is reached. An inference engine using forward chaining searches the inference rules until it finds one in which the if-clause is known to be true. It then concludes the then-clause and adds this information to its data. It would continue to do this until a goal is reached. Because the data available determines which inference rules are used, this method is also called data driven.

Backward chaining starts with a list of goals and works backwards to see if there is data which will allow it to conclude any of these goals. An inference engine using backward chaining would search the inference rules until it finds one which has a then-clause that matches a desired goal. If the if-clause of that inference rule is not known to be true, then it is added to the list of goals. For example, suppose a rulebase contains two rules:

(1) If Fritz is green then Fritz is a frog.

(2) If Fritz is a frog then Fritz hops.

Suppose a goal is to conclude that Fritz hops.The rulebase would be searched and rule (2) would be selected because its conclusion (the then clause) matches the goal. It is not known that Fritz is a frog, so this "if" statement is added to the goal list. The rulebase is again searched and this time rule (1) is selected because its then clause matches the new goal just added to the list. This time, the if-clause (Fritz is green) is known to be true and the goal that Fritz hops is concluded. Because the list of goals determines which rules are selected and used, this method is called goal driven.

CONCLUSION

Two illustrations of actual expert systems can give an idea of how they work. In one real world case at a chemical refinery a senior employee was about to retire and the company was concerned that the loss of his expertise in managing a fractionating tower would severely impact operations of the plant. A knowledge engineer was assigned to produce an expert system reproducing his expertise saving the company the loss of the valued knowledge asset. Similarly a system called

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Mycin was developed from the expertise of best diagnosticians of bacterial infections whose performance was found to be as good or better than the average clinician. An early commercial success and illustration of another typical application (a task generally considered overly complex for a human) was an expert system fielded by DEC in the 1980s to quality check the configurations of their computers prior to delivery. The eighties were the time of greatest popularity of expert systems and interest lagged after the onset of the AI Winter.