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Study on Forward Chaining and Reverse Chaining in Expert System

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Abstract— *Expert systems are part of a general category of computer applications known as intelligence. Expert system are designed to solve complex problems. Expert Systems is a branch of AI designed to work within a particular domain. To solve expert-level problems, expert systems will need efficient access to a substantial domain knowledge base, and a reasoning mechanism to apply the knowledge to the problems they are given. Usually they will also need to be able to explain, to the users who rely on them, how they have reached their decisions. As an expert is a person who can solve a problem with the domain knowledge. This research paper introduces introduction, parts, application of expert system. and difference between forward chaining and Backward chaining and Exactly meaning of Chaining. ETL tools uses functionality to extract, transform and load data from one system into another system, but our expert advises they're not optimal for application-to-application communication. In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. The AI technology has become really advanced and its only matter of time when the machines will be able to learn almost anything. The machine learning algorithms are already very smart, however the Processing power has been a challenge in last decade .Now with the big data and distributed computing revolution this problem has become easy to solve. Many programmers and developers can start programming their own robots and other gadgets on their own. Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving.*

Keywords— Artificial Intelligence, Expert System, Knowledge base, Inference engine,ETL tool.

I. INTRODUCTION

An expert system is an application that gives the knowledge and experience of a human expert. An expert system is designed to provide reasonable answers when given a set of conditions about the problem in hand. For example, a design engineer may be an expert in designing car parts using CAD - they know the capabilities of the materials available and they know what is possible. An expert system is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field .A computer program that contains a knowledge base and a set of algorithms or rules that infer new fact from knowledge and from incoming data.

An expert system is an artificial intelligence application that uses a knowledge base of human expertise to aid in solving problems. The degree of problem solving is based on the quality of the data and rules obtained from the human expert.

Expert systems are designed to perform at a human expert level. Expert System made up of three parts: knowledge base, inference engine, user interface. The knowledge base is made up of facts and rules\The inference engine may use a decision tree or a more advanced heuristic system that can deal with uncertainty. The user interface may be menu based or it may be a more advanced natural language interface**.**

Chaining: Chaining is a learning of a series of behaviors of complete complex act. Each link in the chain serves as a cue for the next response in the chain.

Applications of Expert System:

Classification - identify an object based on stated characteristics

Diagnosis Systems - infer malfunction or disease from observable data

Monitoring - compare data from a continually observed system to prescribe behaviour

Process Control - control a physical process based on monitoring

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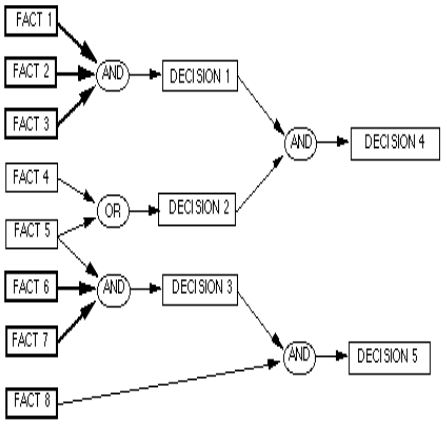
Design - configure a system according to specifications
Scheduling & Planning - develop or modify a plan of action
Generation of Options - generate alternative solutions to a problem
Inference engine uses the following strategies −

- Forward Chaining
- Backward Chaining

II. WORKING OF FORWARD CHAINING

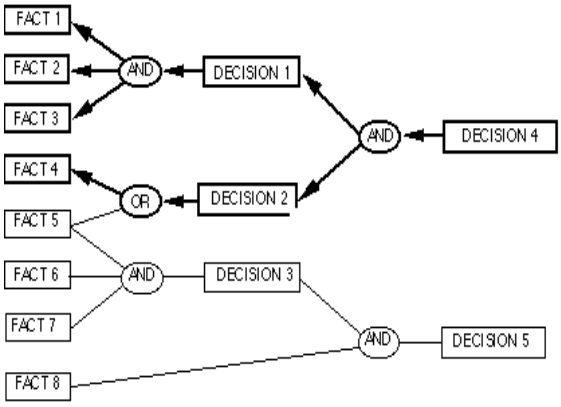
An inference engine using forward chaining searches the inference rules until it finds one where the **If** finds condition is to be true. When found it can conclude, Then condition resulting in the addition of new information to its dataset.It is a strategy of an expert system to answer the question. Here, the interface engine uses the group of conditions and derivations and finally gives the outcome. It considers all the facts and rules, and sorts them before concluding to a solution. This strategy is followed for working on conclusion, result, or effect. For example, prediction of share market status as an effect of changes in interest rates.
1. Examine the rules to find one who's If part is satisfied by the current contents of Working Memory. 2. Execute the rule by adding to Working Memory the facts that are specified in the rules Then part.This control cycle continues until no rules have satisfied If parts.



In above diagram there are number of Facts means conditions .These Facts gives number of decisions and then these decisions gives finally one outcome.The standard definition of a forward-chaining system is that the system operates by repeating the following sequence of operations

Working of Backward Chaining :

Backward Chaining starts with list of goals and works backwards to see if there is a data which will allow to it to conclude ant of these goals.Backwards Chaining starts with some facts and applies rules to find all possible conclusions, the other starts with the desired conclusion(s) and works backwards to find supporting facts. You can sort of view these approaches as two variations on search, with each step forward or backward forming a tree, either spanning out forwards towards conclusions or spanning out backwards towards initial facts.Iif you already know what you are looking for, e.g. a customer that might be committing fraud, a patient at risk for breast cancer, etc., then backward chaining may be a good solution. On the other hand, if you don't necessarily know the final state of your solution, e.g. improvements to a business process, suggesting next steps in a due diligence investigation, or directing data transformations in an ETL process, then a forward chaining approach may be preferrable.On the performance step, there are certain circumstances where backward chaining might be better. For instance, if you have a small number of rules and a huge number of facts, you might be able to lazy load only those facts that are relevant to fulfilling goals. This type of chaining is focused to prove the goal and search as only the part of knowledge base that is related to the problem.



Difference between Forward Chaining and backward chaining:

Backward Chaining	**Forward chaining**
Forward Chaining is known as Goal driven	Backward chaining is known as Data l-driven
It is a top-down reasoning	It is a Bottom-up reasoning
It is a Depth first search.	It is a Breadth first search.
Fast, because it tests fewer rules	It is Slow, because it tests all the rules
Suitable for problems that start from a hypothesis, e.g. diagnosis	Suitable for problems that start from data collection, e.g. planning, monitoring, control

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A small number of initial goals and a large number of rules match the facts	A small number of initial states but a high number of conclusions
Its starts from conclusion	Its starts from New data

III. CONCLUSION

An Expert systems are artificial intelligence (AI) tools that capture the expertise of knowledge workers and provide advice to (usually) non-experts in a given domain. Expert system**,** a computer program that uses artificial-intelligence methods to solve problems within a specialized domain that ordinarily requires human expertise. Forward chaining is a popular implementation strategy for expert systems, business and production rule systems. Backward chaining is an algorithm that works backwards from the goal, chaining through rules to find known facts that support the proof.

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