

Knowledge based expert systems



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What is a knowledge based system?



A Knowledge Based System or a KBS is a computer program that uses artificial intelligence to solve problems within a specialized domain that ordinarily requires human expertise.

Knowledge-based system is a more general than the expert system.

How does it work?



- Problem-solving power does not lie with smart reasoning techniques nor clever search algorithms but domain dependent real-world knowledge.
- Real-world problems do not have well-defined solutions
- KBS allow this knowledge to be represented and creates an explained solution.
- A KBS draws upon the knowledge of human experts captured in a knowledge-base to solve problems that normally require human expertise
- Uses Heuristic (cause-and-effect) rather than algorithms KBS as real-world problem solvers

History



The first knowledge-based systems were rule based expert systems.

Representing knowledge explicitly via rules had several advantages:

- **Acquisition and maintenance-** Using rules meant that domain experts could often define and maintain the rules themselves rather than via a programmer.
- **Explanation:** Representing knowledge explicitly allowed systems to reason about how they came to a conclusion and use this information to explain results to users. For example, to follow the chain of inferences that led to a diagnosis and use these facts to explain the diagnosis.
- **Reasoning:** Decoupling the knowledge from the processing of that knowledge enabled general purpose inference engines to be developed. These systems could develop conclusions that followed from a data set that the initial developers may not have even been aware of.

As knowledge-based systems became more complex the techniques used to represent the knowledge base became more sophisticated.

Rather than representing facts as assertions about data, the knowledge-base became more structured, representing information using similar techniques to [object-oriented programming](#) such as hierarchies of classes and subclasses, relations between classes, and behaviour of objects.

As the knowledge base became more structured reasoning could occur both by independent rules and by interactions within the knowledge base itself. For example, procedures stored as demons on objects could fire and could replicate the chaining behaviour of rules

Components of a KBS



Knowledge base (facts)

Inference Engine

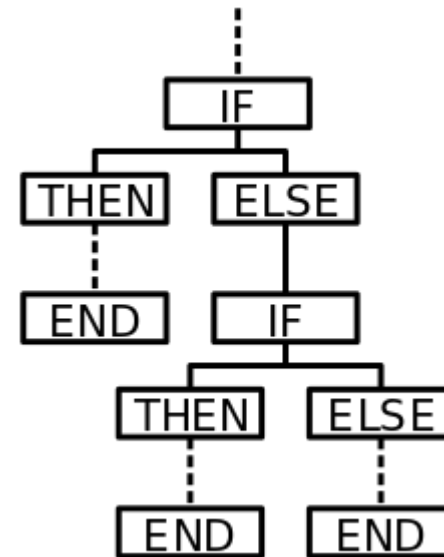
User Interface



Knowledge base

The component of an expert system that contains the system's knowledge organized in collection of facts about the system's domain

- Knowledge is represented in the form of rules using IF ELSE.
These IF ELSE rules is used to form chains of knowledge.
There are 2 types:
- Forward chaining(fact driven)
 - Backward chaining(goal driven)





Inference Engine

It derives answers from the knowledge base.

This is the brain of the expert system that provides a methodology for reasoning about the information in the knowledge base, and for formulating conclusions.



User Interface

The component of an expert system that contains the system's knowledge organized in collection of facts about the system's domain.

The user interface is used by the user to communicate with the knowledge base.

Knowledge engineer and Domain expert



Knowledge engineer:

A knowledge engineer is a computer scientist who knows how to design and implement programs that incorporate artificial intelligence techniques.

Domain Expert:

A domain expert is an individual who has significant expertise in the domain of the expert system being developed.

How is a problem determined?



Knowledge engineer and domain expert work together closely to describe the problem.

The engineer then translates the knowledge into a computer-usable language, and designs an inference engine, a reasoning structure, that uses the knowledge appropriately.

He also determines how to integrate the use of uncertain knowledge in the reasoning process, and what kinds of explanation would be useful to the end user

Advantages and limitations of a KBS



- Increase available of expert knowledge
- Efficient and cost effective
- Consistency of answers
- Explanation of solution
- Deals with uncertainty

- Lack of common sense
- Inflexible, difficult to modify
- Restricted domain of expertise limited to KB
 - Not always reliable