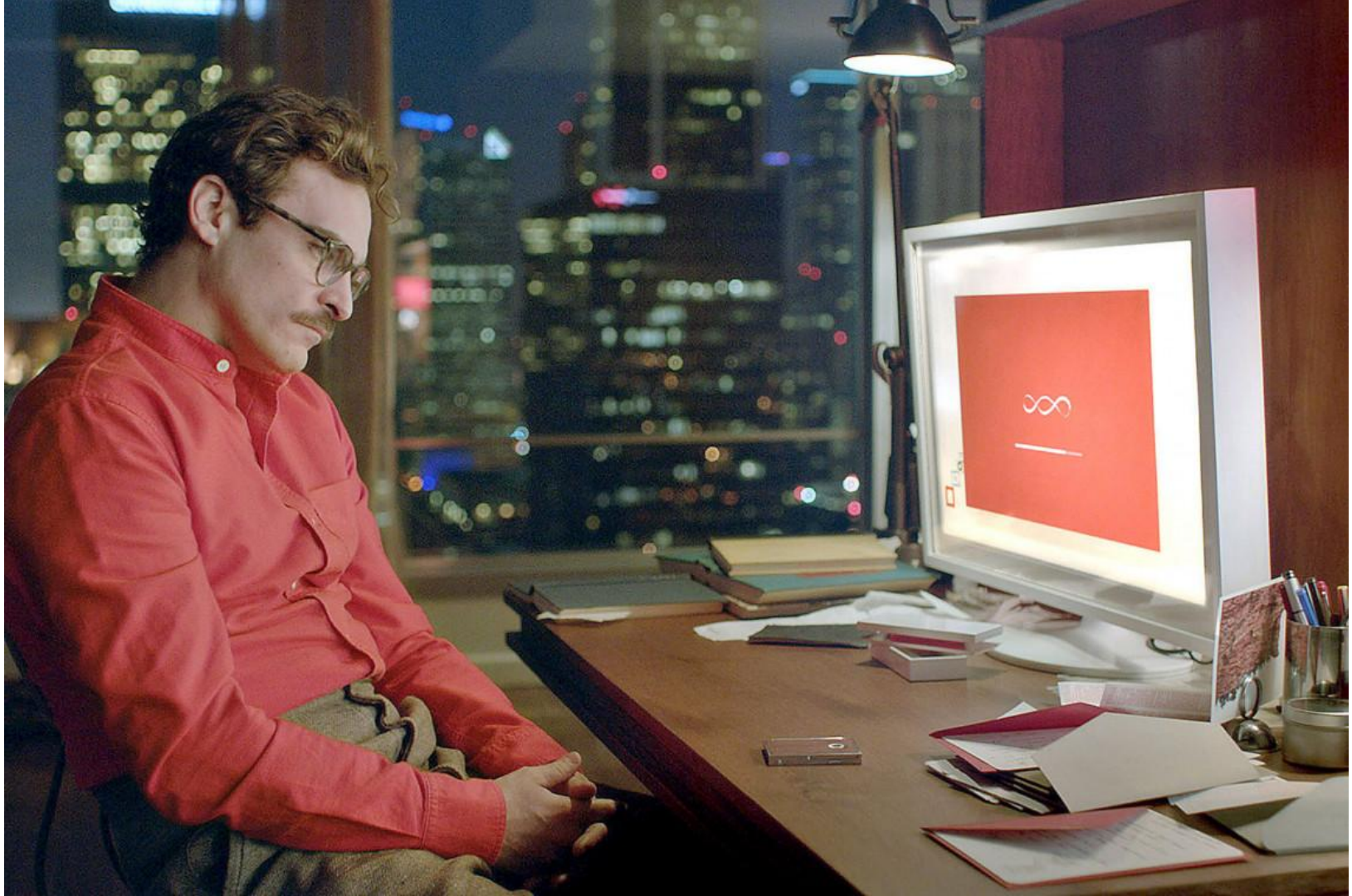


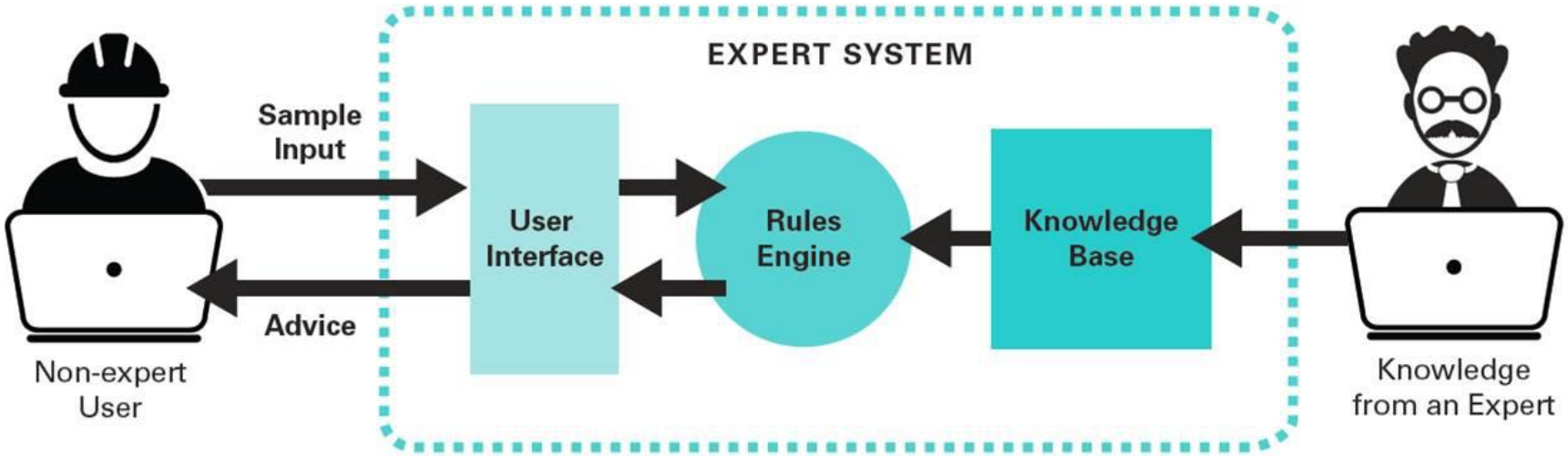
Expert system

Principles of Expert Systems
Peter J.F. Lucas & Linda C. van der Gaag

What's expert system

An **expert system** is a computer system that emulates the decision-making ability of a human expert.

Expert system is a very special branch of Artificial intelligence that makes extensive use of specialised knowledge to solve problem at the level of human expert.



The user inputs information about: the equpment, the component and the oil being tested . . . The Expert System does the rest.

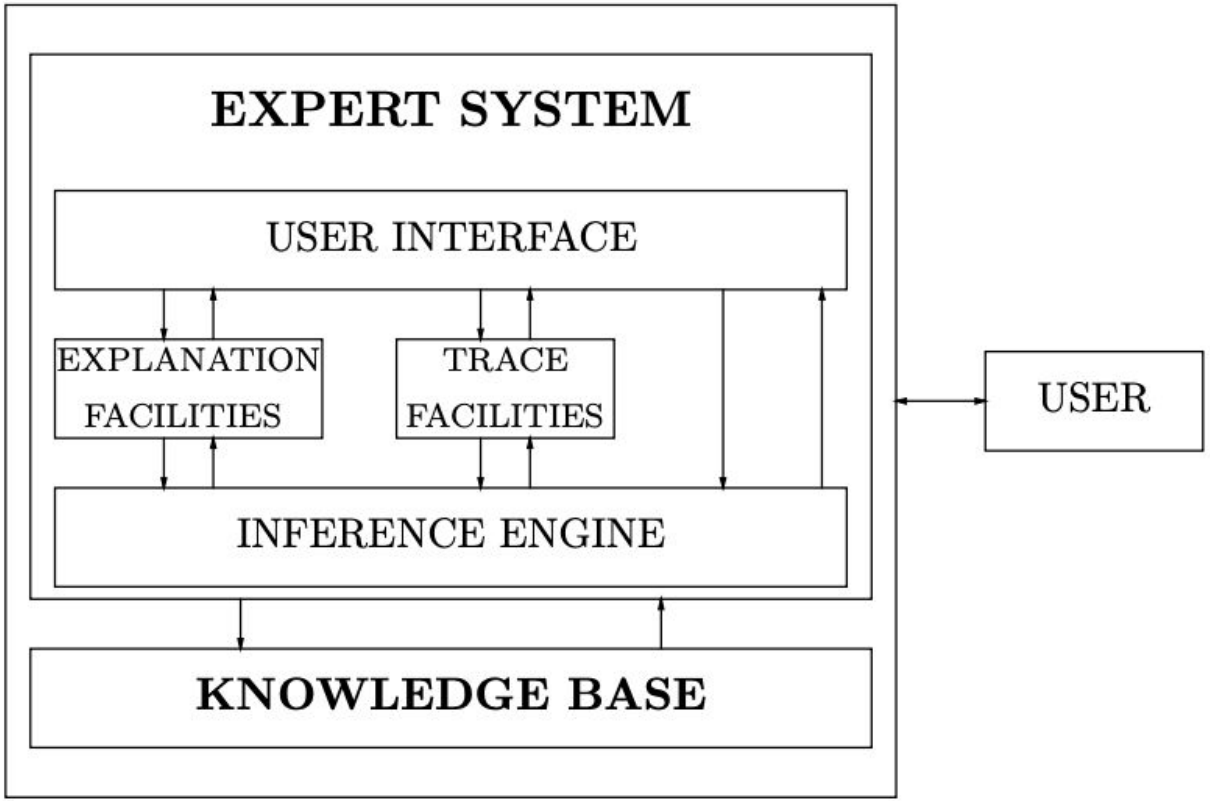


Figure 1.1: Global architecture of an expert system.

What is the main purpose of Expert Systems?

The main purpose of ES is to replicate knowledge and skills of human experts in a particular area, and then to use this knowledge to solve similar problems without human experts participation

What is expert system example?

A computer application that performs a task that would otherwise be performed by a human **expert**. For **example**, there are **expert systems** that can diagnose human illnesses, make financial forecasts, and schedule routes for delivery vehicles.

Examples of Expert Systems

- **MYCIN:** It was based on backward chaining and could identify various bacteria that could cause acute infections. It could also recommend drugs based on the patient's weight.
- **DENDRAL:** Expert system used for chemical analysis to predict molecular structure.
- **PXDES:** Expert system used to predict the degree and type of lung cancer
- **CaDet:** Expert system that could identify cancer at early stages

https://www.guru99.com/expert-systems-with-applications.html

Is it an expert system?

Is it an expert system?

What are the types of expert system?

There are mainly five types of expert systems.

- ➔ **Rule based expert system**
- ➔ **Fuzzy expert system**
- ➔ **Frame based expert system.**
- ➔ **Neural expert system**
- ➔ **Neuro-fuzzy expert system**

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Rule based expert system

1

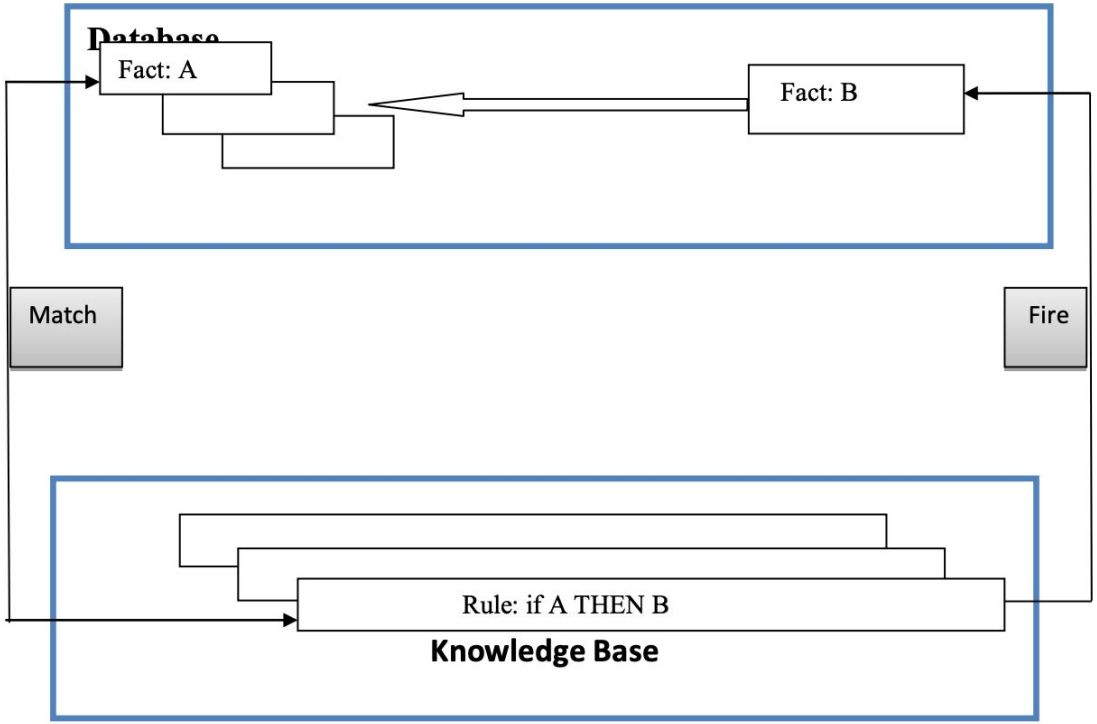


Figure 2: Inference process for rule based expert system

Rule based expert system

Table 1: Difference between forward chaining and backward chaining:

Forward chaining	Backward chaining
The data is known at the beginning of the inference process, and the user is not required to input additional facts.	The goal is set up and the only needed data from the database is used for reasoning. User is only required to input facts which is not in the database.
Developers should choose the forward chaining when they need to gather some information first and then want to infer something from that.	Developers should choose backward chaining when they begin with hypothetical solution and then search for facts to prove it.
Dendral, an expert system for determining molecular structure of unknown soil uses forward chaining.	MYCIN, an expert system for diagnosis infectious blood disease uses backward chaining

2

Fuzzy Expert Systems

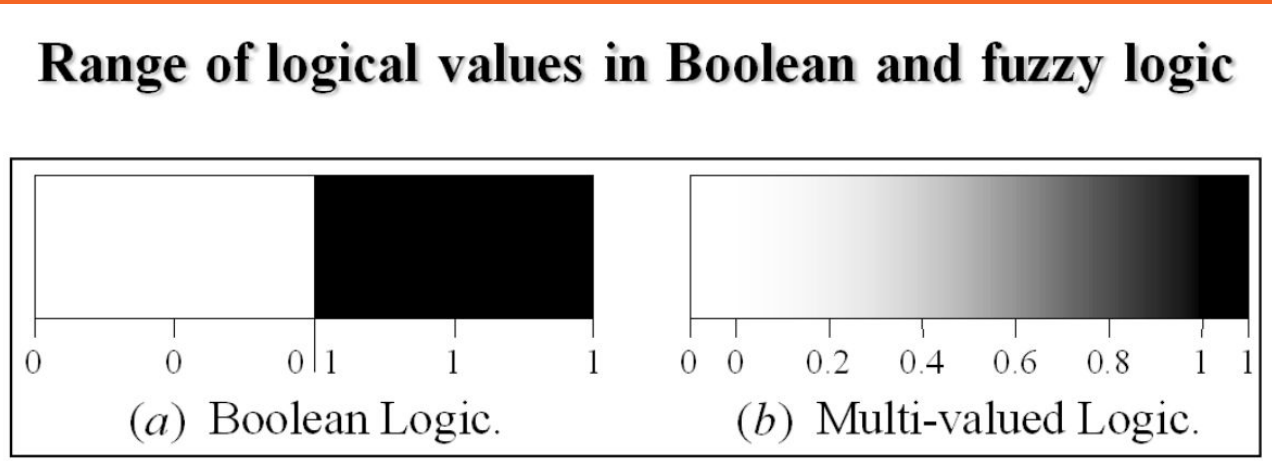


Figure 3: Fuzzy logic

3

Frame Based Expert Systems

A frame is a data structure with typical knowledge about a particular object or concept. Frames are used to capture and represent knowledge in a frame based expert system. Each frame has its own name and set of attributes or slots associated with it.

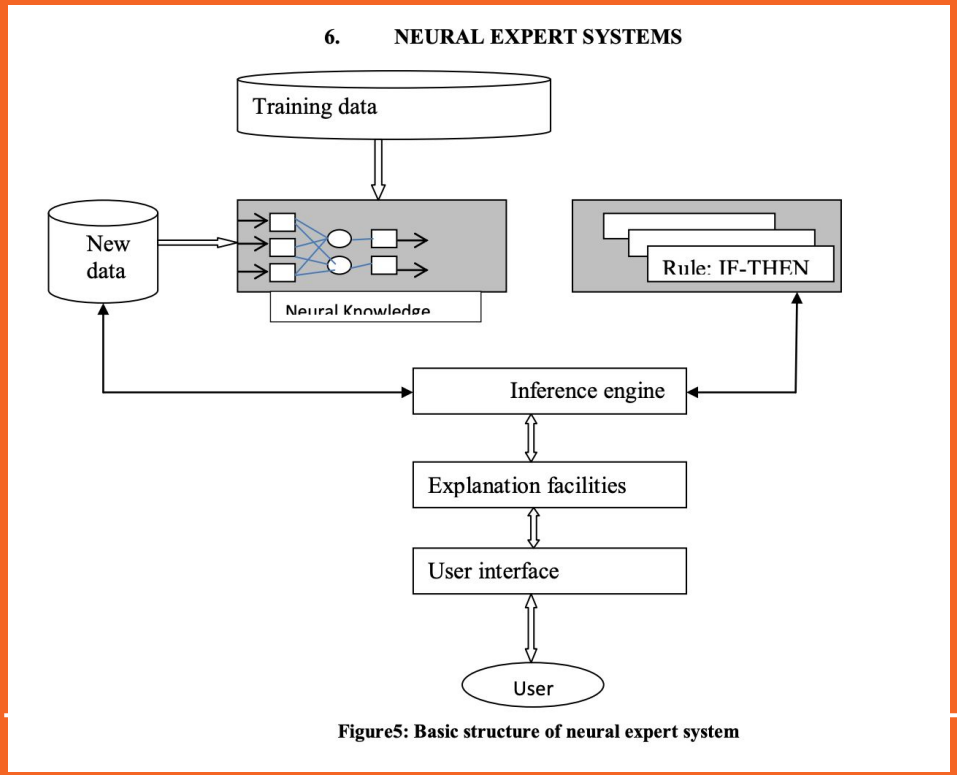
3

Frame Based Expert Systems

A facet is a means of providing extended knowledge about an attribute of a frame. Facets are used to establish the attribute value, end-user queries, and tell the inference engine how to process the attribute.

4

Neural Expert Systems



4

Neural Expert Systems

Neural network and expert systems both have a common goal of imitating the human intelligence. A hybrid expert system, which combines a neural network and a rule based expert system, is called a neural expert system.

Neural network also allows dealing with noisy and incomplete data because of its capability of generalisation. Hence it allows approximate reasoning. The rule extraction unit examines the neural knowledge base and produces the rules implicitly buried in the trained neural network.

5

Neuro-Fuzzy Expert Systems

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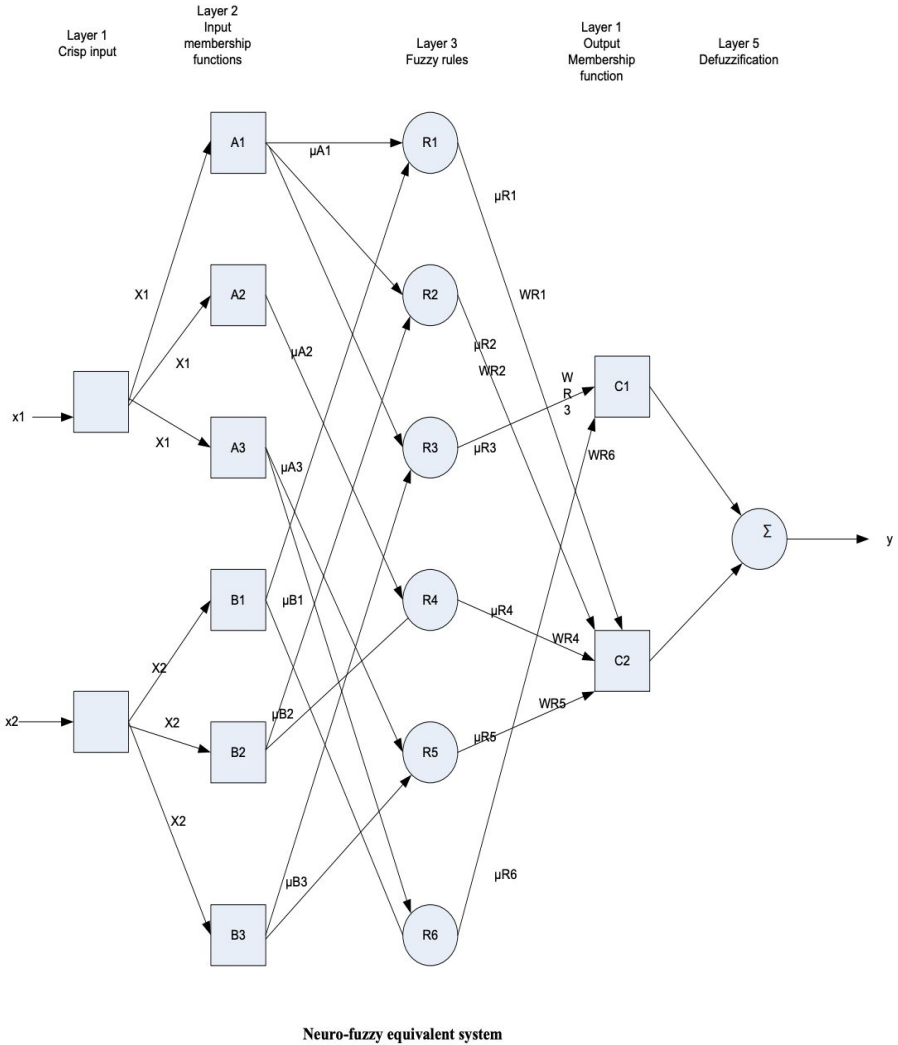

Neuro-fuzzy equivalent system

Neuro-Fuzzy Expert Systems

Each layer in the neuro-fuzzy system is associated with a particular step in the fuzzy inference process.

5

Human expert vs. expert system

Human Expert	Artificial Expertise
Perishable	Permanent
Difficult to Transfer	Transferable
Difficult to Document	Easy to Document
Unpredictable	Consistent
Expensive	Cost effective System

Benefits of expert systems

- It improves the decision quality
- Cuts the expense of consulting experts for problem-solving
- It provides fast and efficient solutions to problems in a narrow area of specialization.
- It can gather scarce expertise and used it efficiently.
- Offers consistent answer for the repetitive problem
- Maintains a significant level of information
- Helps you to get fast and accurate answers
- A proper explanation of decision making
- Ability to solve complex and challenging issues
- Expert Systems can work steadily work without getting emotional, tensed or fatigued.

Limitations of the expert system

- Unable to make a creative response in an extraordinary situation
- Errors in the knowledge base can lead to wrong decision
- The maintenance cost of an expert system is too expensive
- Each problem is different therefore the solution from a human expert can also be different and more creative

Applications of expert systems

- Information management
- Hospitals and medical facilities
- Help desks management
- Employee performance evaluation
- Loan analysis
- Useful for repair and maintenance projects
- Warehouse optimization
- Planning and scheduling
- Financial decision making Knowledge publishing
- Process monitoring and control
- Supervise the operation of the plant and controller
- Stock market trading
- Airline scheduling & cargo schedules

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