Unit-7

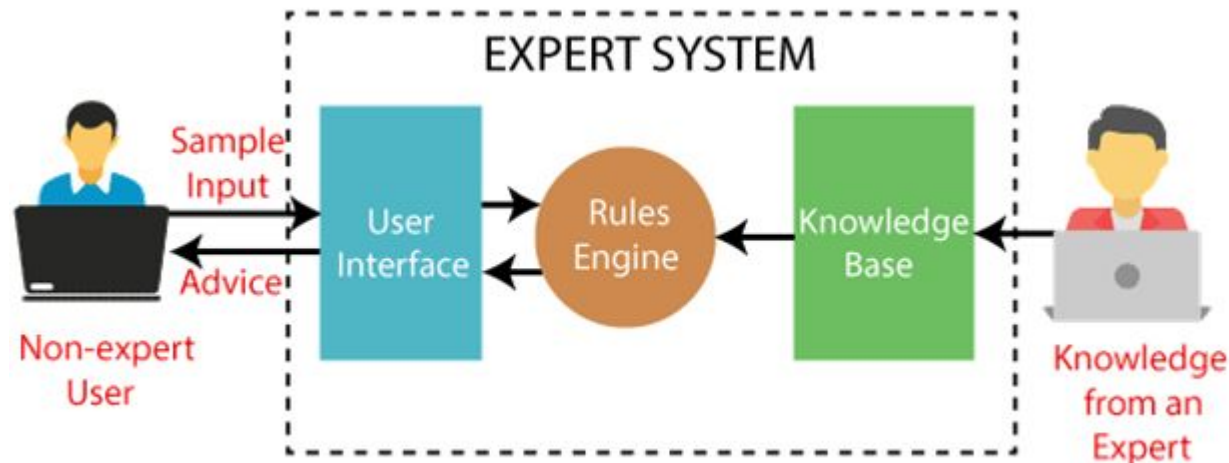## Expert Systems

What is an Expert System?

- Computer program that is designed to solve complex problems and to provide decision-making ability like a human expert.

- Extract knowledge from its knowledge base using the reasoning and inference rules according to the user queries.

- Contains the expert knowledge of a specific domain and can solve any complex problem of that particular domain.

- These systems are designed for a specific domain, such as medicine, science, etc.
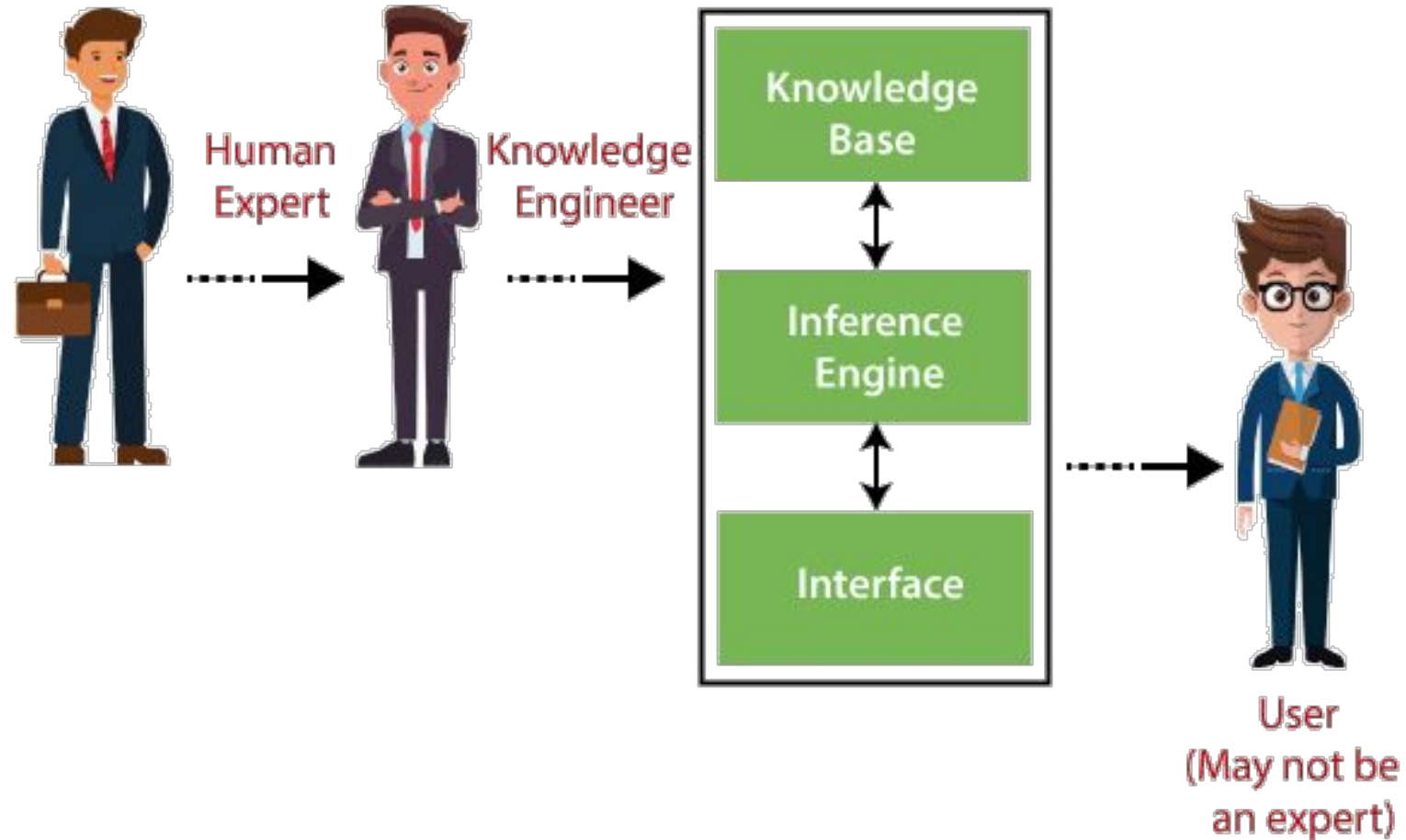
Some Expert Systems

- **DENDRAL:** chemical analysis

- **MYCIN:** Medical

- **PXDES:** Lung cancer

- **CaDeT:** Detect cancer at early stages

Characteristics of Expert System

- **High Performance**

- **Understandable**

- **Reliable**

- **Highly responsive**

Components of Expert System

Human Expert → Knowledge Engineer → [Knowledge Base ↕ Inference Engine ↕ Interface] → User (May not be an expert)

1. User Interface

- With the help of a user interface, the expert system interacts with the user, takes **queries** as an input in a readable format, and passes it to the inference engine.

- After getting the response from the inference engine, it displays the output to the user.

- In other words, it is an interface that helps a non-expert user to communicate with the expert system to find a solution.

2. Inference Engine

• brain of the expert system as it is the main processing unit of the system

• **Deterministic Inference engine:** The conclusions drawn from this type of inference engine are assumed to be true. It is based on facts and rules.

• **Probabilistic Inference engine:** This type of inference engine contains uncertainty in conclusions, and based on the probability.

• Inference Engine uses **forward chaining / backward chaining** to derive the solution.

3. Knowledge Base

• stores knowledge acquired from the different experts (similar to database)

• collections of objects and their attributes

• Two components: **Factual Knowledge** & **Heuristic Knowledge**

Knowledge Acquisition in Expert Systems

- Knowledge acquisition is the process of extracting, structuring and organizing knowledge from one source, usually human experts, so it can be used in software such as an ES.

- This is often the major obstacle in building an ES.

- There are **three** main topic areas central to knowledge acquisition that require consideration in all ES projects.

  - **First**, the domain must be evaluated to determine if the type of knowledge in the domain is suitable for an ES.

  - **Second**, the source of expertise must be identified and evaluated to ensure that the specific level of knowledge required by the project is provided.

  - **Third**, if the major source of expertise is a person, the specific knowledge acquisition techniques and participants need to be identified.

Advantages of Expert System

- highly reproducible

- They can be used for risky places where the human presence is not safe.

- Error possibilities are less if the KB contains correct knowledge.

- The performance of these systems remains steady as it is not affected by emotions, tension, or fatigue.

- They provide a very high speed to respond to a particular query.

Limitations of Expert System

- The response of the expert system may get wrong if the knowledge base contains the wrong information.

- Like a human being, it cannot produce a creative output for different scenarios.

- Its maintenance and development costs are very high.

- Knowledge acquisition for designing is much difficult.

- For each domain, we require a specific ES, which is one of the big limitations.

- It cannot learn from itself and hence requires manual updates.