Unit 6
Knowledge based systems

- Artificial intelligence
- Expert systems
- Neural networks

Knowledge based system:

- A knowledge-based system (KBS) is a computer system which generates and utilizes knowledge from different sources, data and information.
- These systems aid in solving problems, especially complex ones, by utilizing artificial intelligence concepts.
- These systems are mostly used in problem-solving procedures and to support human learning, decision making and actions.
- Knowledge-based systems are considered to be a major branch of artificial intelligence. They are capable of making decisions based on the knowledge residing in them, and can understand the context of the data that is being processed.
- A knowledge-based system is comprised of a knowledge base and an interface engine.
- The knowledge base functions as the knowledge repository, while the interface engine functions as the search engine.
- Learning is a key element to a knowledge-based system, and learning simulation improves the system over time.

Artificial Intelligence

- Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence.
- IT refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions.
- The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving.
- A subset of artificial intelligence is machine learning, which refers to the concept that computer programs can automatically learn from and adapt to new data without being assisted by humans.
- Deep learning techniques enable this automatic learning through the absorption of huge amounts of unstructured data such as text, images, or video.

Application area of Artificial Intelligence

- AI domain is very large and its application spreads in wide areas of business and industry. The figure below shows the major application areas of AI.

Fig. 14.12 *Application Areas of Artificial Intelligence*
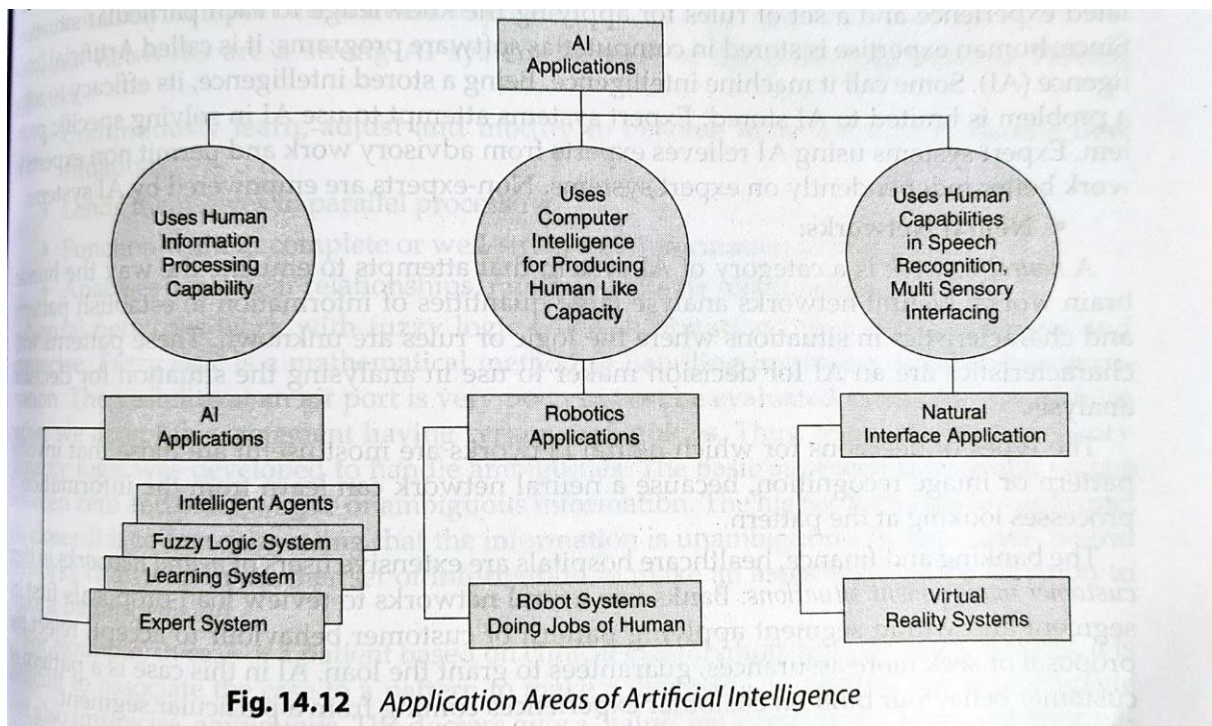
- Cognitive science application uses knowledge and human information processing capabilities to produce major application as expert systems. Expert systems are designed to make humanlike inferences leading to an advice to decision maker. Fuzzy logic is the input information which is incomplete and imprecise.
- Robotics application uses AI, engineering science and physiology to produce computer intelligence to guide a computer driven machine to perform like human being.
- Natural interface application uses AI to build natural, realistic, multi-sensory human computer interface. This interface enables us to build a virtual reality.

Expert Systems

- Expert systems are comprised application systems driven by "Artificial Intelligence".
- It stores human intelligence made out of expert's experience, knowledge and model of solving problem.
- Expert system includes a knowledge base containing various accumulated experience and set of rules for applying the knowledge to each particular situation.
- Since, human expertise is stored in computer as software programs; it is called AI.
- Expert system attempts to use AI in solving specific problems.
- In artificial intelligence, an expert system is a computer system emulating the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code.

Characteristics of Expert System

- **High Performance:** The expert system provides high performance for solving any type of complex problem of a specific domain with high efficiency and accuracy.
- **Understandable:** It responds in a way that can be easily understandable by the user. It can take input in human language and provides the output in the same way.
- **Reliable:** It is much reliable for generating an efficient and accurate output.
- **Highly responsive:** ES provides the result for any complex query within a very short period of time.

Components of Expert System

An expert system mainly consists of three components:

- User Interface
- Inference Engine
- Knowledge Base
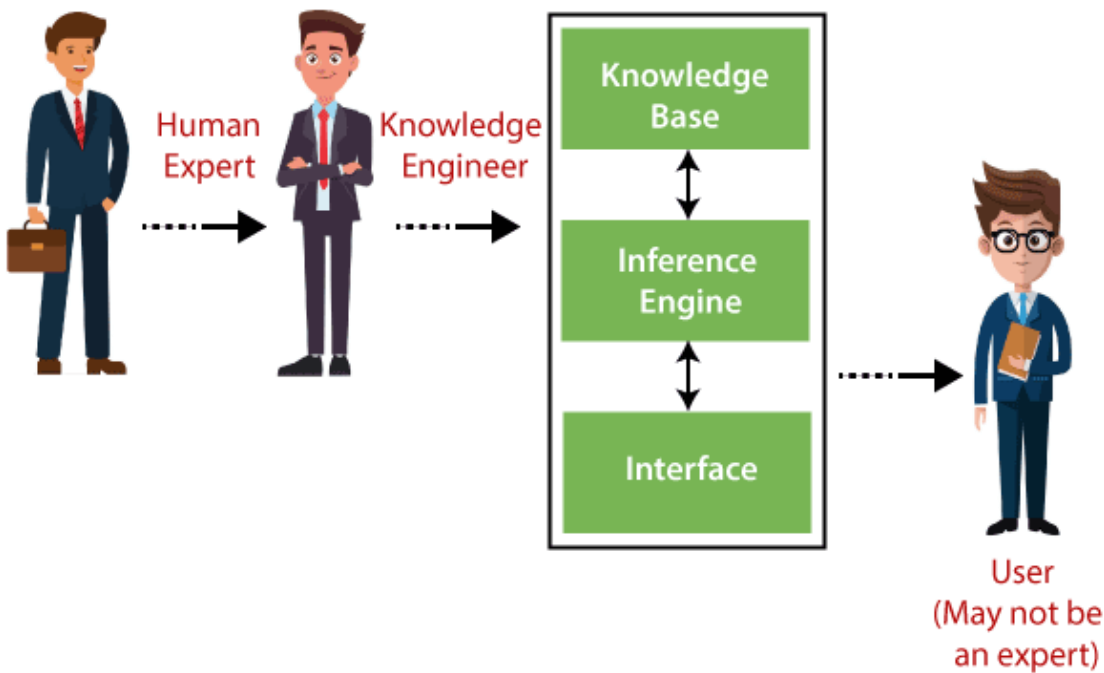
User Interface
- This component takes the user's query in a readable form and passes it to the inference engine.
- After that, it displays the results to the user.
- In other words, it's an interface that helps the user communicate with the expert system.

Inference Engine
- The inference engine is the brain of the expert system.
- Inference engine contains rules to solve a specific problem. It refers the knowledge from the Knowledge Base.
- It selects facts and rules to apply when trying to answer the user's query.
- It provides reasoning about the information in the knowledge base.
- It also helps in deducting the problem to find the solution.

Knowledge Base
- The knowledge base is a repository of facts.
- It stores all the knowledge about the problem domain.
- It is like a large container of knowledge which is obtained from different experts of a specific field.

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.
- Offers consistent answer for the repetitive problem
- Maintains a significant level of information
- Helps you to get fast and accurate answers
- Ability to solve complex and challenging issues
- Artificial Intelligence Expert Systems can steadily work without getting emotional, tensed or fatigued.

Neural Networks:
- A neural network is a category of AI system that attempts to emulate the way the human brain works.

- Neural networks analyze large quantities of information to establish patterns and characteristics in situations where the logic or rules are unknown.
- A neural network is a series of algorithms that endeavors to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.
- In this sense, neural networks refer to systems of neurons, either organic or artificial in nature.
- Neural networks can adapt to changing input; so, the network generates the best possible result without needing to redesign the output criteria.
- Neural networks analyze large quantities of information to establish patterns and characteristics in situations where the logic or rules are unknown.
- These patterns with characteristics are an AI for decision maker to use in analyzing the situation for decision analysis.
- The types of decisions for which the neural networks are most useful are those that involve pattern or image recognition, because neural network can learn from the information it processes looking at the pattern.

A simple neural network

input layer   hidden layer   output layer
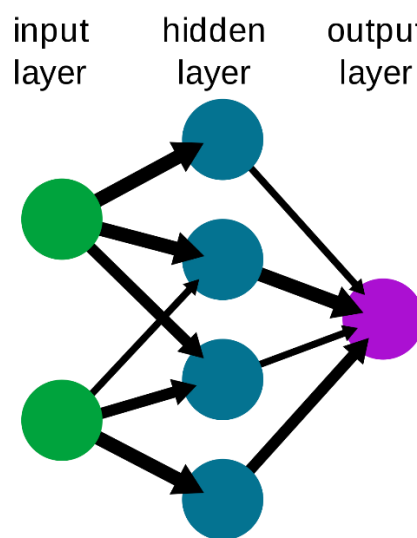
Use Case/Applications

- Police and investigation agencies use neural networks to judge nature of crime.
- With crime reports as input, neural network system can detect map local crime patterns. The police would judge using the pattern.
- Hospitals use neural networks for patient treatment and medication behaviors.
- Many insurance companies use neural network software to identify fraud also.