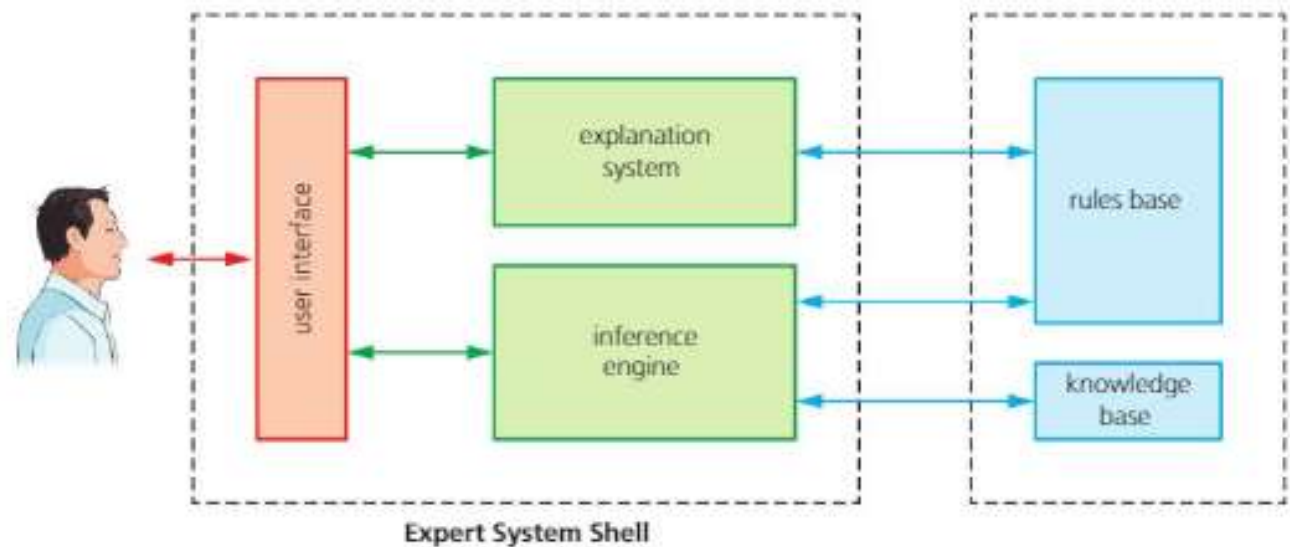


6.3 ARTIFICIAL INTELLIGENCE (AI)

- AI can be thought of as a machine with cognitive abilities such as problem solving and learning from examples
- AI is often split into three categories
 - Narrow AI is when a machine has superior performance to a human when doing one specific task.
 - General AI is when a machine is similar in its performance to a human in any intellectual task.
 - Strong AI is when a machine has superior performance to a human in many tasks.
- Examples of AI include:
 - news generation based on live news feeds
 - smart home devices (such as Amazon Alexa, Google Now, Apple Siri and Microsoft Cortana)
 - Chatbots in instant messaging
 - Autonomous cars
 - Facial expression recognition

6.3.3 AI SYSTEMS

- Expert systems
 - It is a form of AI that mimic human knowledge and experiences
 - Examples
 - Akinator (game)
 - It has 4 components
 - User interface
 - Inference engine
 - Knowledge base
 - Rules base



6.3.3 AI SYSTEMS

- Expert system

- Knowledge base

- it stores all the knowledge about an area of expertise obtained from a number of expert resources
 - the knowledge base is a repository of facts
 - it is basically a collection of objects and their attributes
 - Inference engine and rule base are using these information to make a decision

Object	Attribute 1	Attribute 2	Attribute 3	Attribute 4	Attribute 5	Attribute 6
dog	mammal	can be a pet	lives on land	makes bark sounds	body is covered in fur	walks on 4 legs
whale	mammal	not a pet	lives in water	makes sonic sound	body covered in skin	swims; no legs
duck	bird	not a pet	lives in water	makes quack sounds	body covered in feathers	swims; has two legs

6.3.3 AI SYSTEMS

- Expert system
 - User interface
 - method by which the expert system interacts with a user
 - interaction can be through dialogue boxes, command prompts or other input methods
 - Inference engine
 - the inference engine acts like a search engine examining the knowledge base for information/data that matches the queries
 - it is responsible for gathering information from the user by asking a series of questions and applying responses where necessary; each question being asked is based on the previous responses
 - the inference engine is the problem-solving part of the expert system that makes use of inference rules in the rules base
 - since the knowledge base is a collection of objects and attributes, the inference engine attempts to use information gathered from the user to find an object that matches (making use of the rules base to find a match)

6.3.3 AI SYSTEMS

- Expert system

- Rules base

- the rules base is a set of inference rules
 - inference rules are used by the inference engine to draw conclusions (the methods used closely follow human reasoning)
 - they follow logical thinking like the example above; usually involving a series of 'IF' statements, for example:

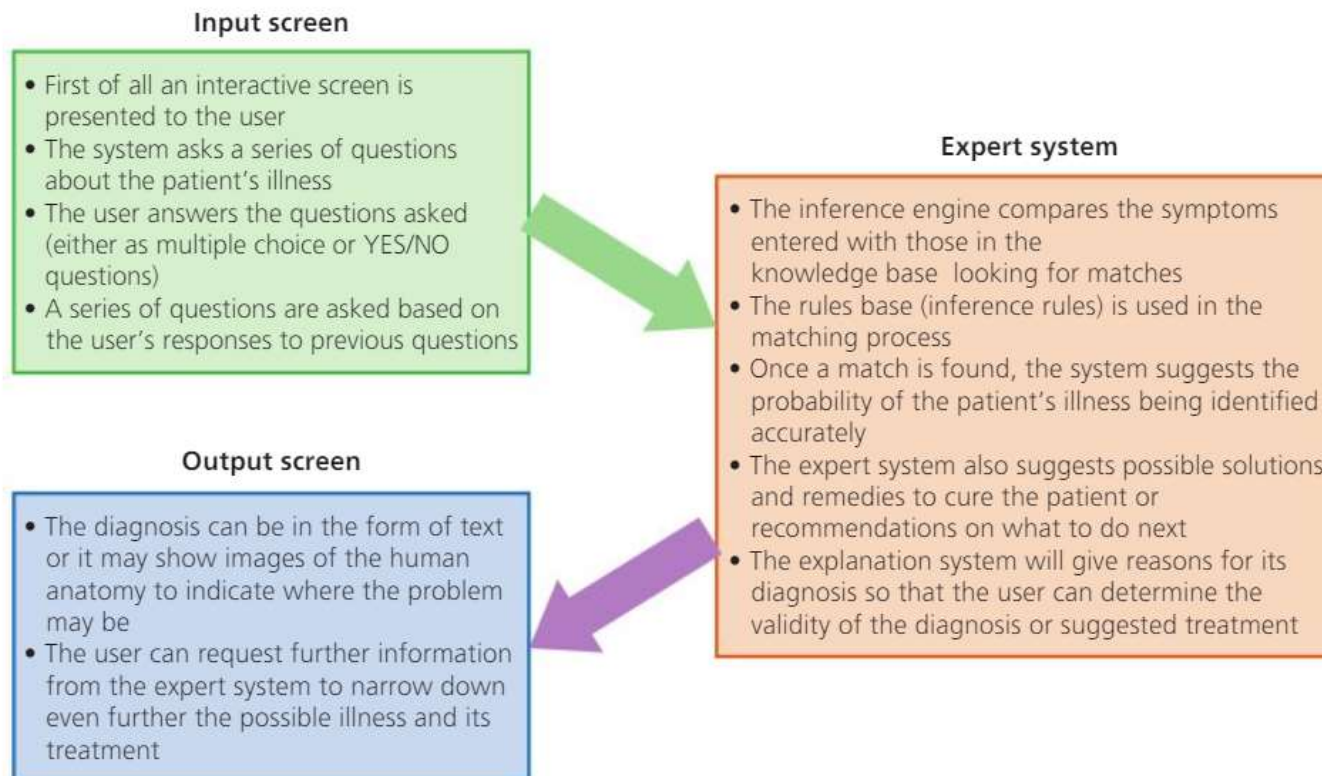
IF continent = "South America" AND language = "Portuguese" THEN country = "Brazil"

- Applications

- oil and mineral prospecting
 - diagnosis of a patient's illness
 - fault diagnostics in mechanical and electronic equipment
 - tax and financial calculations
 - strategy games, such as chess
 - logistics (efficient routing of parcel deliveries)
 - identification of plants, animals and chemical/biological compounds

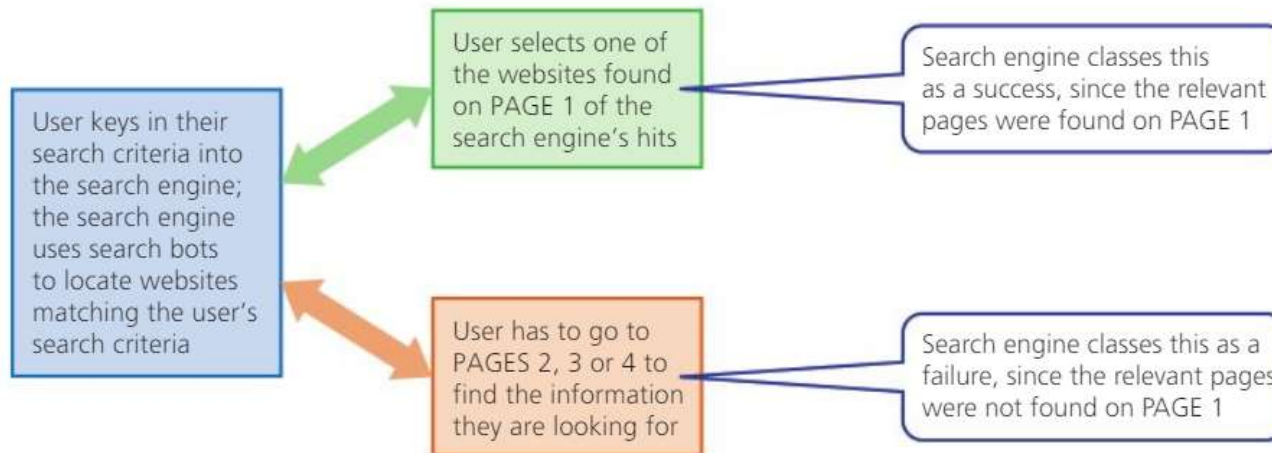
6.3.3 AI SYSTEMS

Example use of an expert system (medical diagnosis)

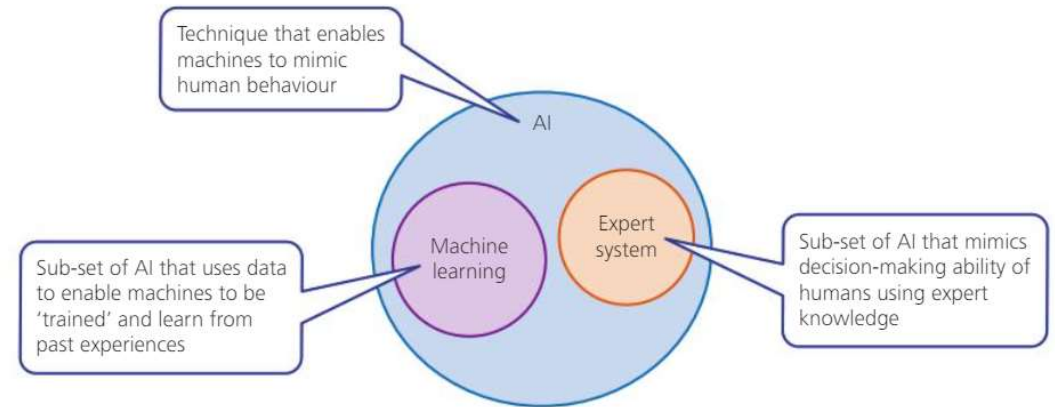


6.3.3 AI SYSTEMS

- Machine learning
 - Algorithms are 'trained' and learn from their past experiences and examples
 - It is possible for the system to make predictions or even take decisions based on previous scenarios.
 - It has ability to automatically adapt or improve itself
 - An example, The search engine will learn from its past performance, meaning its ability to carry out searches becomes more sophisticated and accurate



6.3.3 AI SYSTEMS



AI	Machine learning
represents simulated intelligence in machines	this is the practice of getting machines to make decisions without being programmed to do so
the aim is to build machines that are capable of thinking like humans	the aim is to make machines that learn through data acquisition, so that they can solve new problems

6.3.3 AI SYSTEMS

Examples of machine learning

? Example 1: Categorising email as spam

Consider email messages such as *'You have won \$2 million in the National Lottery'*; how can machine learning determine that this email should be put into your spam folder?

- » A machine learning algorithm collects data about emails, such as email content, headers, senders name/email address and so on.
- » It carries out a 'cleaning' process by removing **stop words** (for example, the, and, a) and punctuation, leaving only the relevant data.
- » Certain words/phrases are frequently used in spam (for example, lottery, earn, full-refund) and indicate that the incoming email is very likely to be spam.
- » The machine learning model is built and a 'training data set' is used to train the model and make it learn using past email known to be spam.
- » Once it is evaluated, the model is fine-tuned and tested live.

6.3.3 AI SYSTEMS



Example 2: Recognising user buying history

When you visit an online retailer, such as Amazon, you might receive the message *'customers who bought Hodder Education IGCSE ICT textbook also bought Hodder Education IGCSE Computer Science textbook'*. How is machine learning used to establish a user's buying characteristics?

- » This comes from **collaboration filtering**, which is the process of comparing customers who have similar shopping behaviour to a new customer who has similar shopping behaviour.
- » Suppose customer 'A' is very interested in playing football and they also bought a jazz CD, a book on Roman history and some health food.
- » Two weeks later, customer 'B' who likes to go cycling also bought a similar jazz CD and a book on ancient Roman history.
- » The machine learning algorithms will then recommend that customer 'B' might like to buy some health food due to the similarities between 'A' and 'B's shopping behaviour.
- » This technique is particularly popular when asking your mobile phone to generate a playlist from your music library based on a few criteria you might select.

QUESTIONS

- Explain why an expert system needs a knowledge base.
- Identify three other components that are present in an expert system.
- State what is meant by machine learning.