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| COLLEGE OF MANAGEMENT & INFORMATION TECHNOLOGY  **BACHELOR IN INFORMATION TECHNOLOGY**  **Mobile Computing**  **BIT**  **Submitted by: Submitted by:**  Name: Amir Shrestha Saroj Poudel  Year/ Semester: III Year /V Semester  LCID: LC00017000502  **Date: 7/29/2021** |

**QUESTION No 1:**

What is an expert system? Explain the architecture and feature of rule-based expert system.

**Answer:**

An expert system is an example of a knowledge-based system that use a knowledge-based architecture, emulating the decision-making ability of a human expert designed to solve complex problems and to provide decision-making ability like a human expert by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code.

It is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field.

Components of Expert System:

* User Interface
* Inference Engine
* Knowledge Base

The knowledge base represents facts and rules and the inference engine applies the rules to the known facts to deduce new facts. Some systems encode expert knowledge as rules and are therefore referred to as rule-based systems. Therefore, Knowledge-Base expert system also known as rule-based expert system.

What is knowledge?

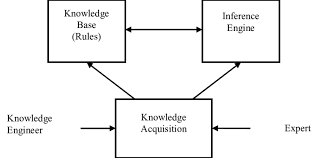
The data is collection of facts. The information is organized as data and facts about the task domain. Data, information, and past experience combined together are termed as knowledge. Factual Knowledge & Heuristic Knowledge

What is knowledge-based expert system?

The knowledge base is a repository of facts. It stores all the knowledge about the problem in specific domains along with rules in order to solve problems. It is like a large container of knowledge which is obtained from different experts of a specific field.

According to radiopaedia "A rule-based expert system is the simplest form of artificial intelligence and uses prescribed knowledge-based rules to solve a problem 1. The aim of the expert system is to take knowledge from a human expert and convert this into several hardcoded rules to apply to the input data. In their most basic form, the rules are commonly conditional statements (if a, then do x, else if b, then do y). These systems should be applied to smaller problems, as the more complex a system is, the more rules that are required to describe it, and thus increased difficulty to model for all possible outcomes."

Architecture figure:



1. User Interface: It is the mechanism by which the user and the expert system communicate with each other

2. Explanation Module: The explanation module explains the reasoning of the system to a user.

3. Working Memory: It is a global database of facts used by the rules.

Some of features of rule-based expert system are mentioned below:

1. The knowledgebase is a type of storage that stores knowledge acquired from the different experts of the domain. It is considered as big storage of knowledge. The more the knowledge base, the more precise will be the Expert System.

2. It is like a database that contains information and rules of a particular domain or subject.

3. One can also view the knowledge base as collections of objects and their attributes. Such as a Lion is an object and its attributes are it is a mammal, it is not a domestic animal, etc.

**QUESTION No 2:**

What do you mean by machine vision? Discuss the components of a machine vision system.

**Answer:**

Machine vision refers to many technologies, software and hardware products, integrated systems, actions, methods and expertise used to provide imaging-based automatic inspection and analysis for such applications as automatic inspection, process control, and robot guidance, usually in industry by using image processing. .

Definitions of the term "Machine vision" vary, but all include the technology and methods used to extract information from an image on an automated basis, as opposed to image processing, where the output is another image.

Machine vision is used in a variety of industrial processes, such as material inspection, object recognition, pattern recognition, electronic component analysis, along with the recognition of signatures, optical characters, and currency.

Machine vision is the capability of a computer to perceive the environment. One or more video cameras are used with analog-to-digital conversion and digital signal processing. The image data is sent to a computer or robot controller.

The major components of a machine vision system include the lighting, lens, image sensor, vision processing, and communications.

Lighting illuminates the part to be inspected allowing its features to stand out so they can be clearly seen by camera.

The lens captures the image and presents it to the sensor in the form of light.

sensor in a machine vision camera converts this light into a digital image which is then sent to the processor for analysis.

Vision processing consists of algorithms that review the image and extract required information, run the necessary inspection, and make a decision.

Communication is typically accomplished by either discrete I/O signal or data sent over a serial connection to a device that is logging information or using it.

**QUESTION No 3:**

Explain Adversarial search techniques‐minimax procedure and alpha beta procedure

**Answer:**

Adversarial search is a search, where we examine the problem which arises when we try to plan of the world and other agents are planning against us.Searches in which two or more players with conflicting goals are trying to explore the same search space for the solution, are called adversarial searches, often known as Games.

Alpha-beta pruning is a modified version of the minimax algorithm. It is an optimization technique for the minimax algorithm. There is a technique by which without checking each node of the game tree we can compute the correct minimax decision, and this technique is called pruning. This involves two threshold parameter Alpha and beta for future expansion, so it is called alpha-beta pruning. It is also called as Alpha-Beta Algorithm.

**QUESTION No 4:**

Explain Machine vision uses in Robotics.

**Answer:**

A machine vision system uses a sensor in the robot for viewing and recognizing an object with the help of a computer.It is mostly used in industrial robotics Cameras have become more powerful and more accurate in rugged industrial settings than ever before.Machine vision allows a robot to see what it’s doing, in a sense. Without machine vision the robot would be blind – only capable of repeating the same exact task over and over until it’s reprogrammed.

Vision also helps robots collaborate with human workers, and to integrate information from visual sources with that coming in from different sensors. This integration can help robots understand their location in space. These benefits have driven the applications of machine vision in robots.

**QUESTION No 5:**

What is Bayesian Network? Explain how Bayesian Network represents and inference the uncertain knowledge.

**Answer:**

According to Wikipedia "A Bayesian network is a probabilistic graphical model that represents a set of variables and their conditional dependencies via a directed acyclic graph."

Its represents knowledge about an uncertain domain where each node corresponds to a random variable and each edge represents the conditional probability for the corresponding random variables. Bayesian networks are probabilistic, because these networks are built from a probability distribution, and also use probability theory for prediction and anomaly detection. Bayesian inference is a method of statistical inference in which Bayes' theorem is used to update the probability for a hypothesis as more evidence or information becomes available.

**QUESTION No 6:**

Explain Q-Learning for Learning policies.

**Answer:**

According to geekdforgeeks "Q-Learning is a basic form of Reinforcement Learning which uses Q-values (also called action values) to iteratively improve the behavior of the learning agent."

Q-learning is an off policy reinforcement learning algorithm that seeks to find the best action to take given the current state. It's considered off-policy because the q-learning function learns from actions that are outside the current policy, like taking random actions, and therefore a policy isn't needed.

**QUESTION No 7:**

Explain resolution refutation system (RRS) and rule based deduction system.

**Answer:**

Resolution is a theorem proving technique that proceeds by building refutation proofs and resolution is used, if there are various statements are given, and we need to prove a conclusion of those statements.

In general, a resolution refutation for proving an arbitrary wff, ω, from a set of wffs, Δ, proceeds as follows:

* Convert the wffs in Δ to clause form—a (conjunctive) set of clauses.
* Convert the negation of the wff to be proved, ω, to clause form.
* Combine the clauses resulting from steps 1 and 2 into a single set, Γ.
* Iteratively apply resolution to the clauses in Γ and add the results to Γ either until there are no more resolvents that can be added or until the empty clause is produced.

In computer science, a rule-based system is used to store and manipulate knowledge to interpret information in a useful way. It is often used in artificial intelligence applications and research. Normally, the term rule-based system is applied to systems involving human-crafted or curated rule sets.

Example:

if the person has fever and feels tummy-pain then she may have aninfection.

In logic it can be expressed as follows:

\-/x. (has\_fever(x) & tummy\_pain(x) \-/ has\_an\_infection(x))

**Reference**:

<https://www.cognex.com/what-is/machine-vision/components>

https://towardsdatascience.com/simple-reinforcement-learning-q-learning-fcddc4b6fe56

Thank You!