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**COM/1002/18**

**COM 418: EXPERT SYSTEMS**

**CAT 2.**

1. Describe how uncertainty occurs in the knowledge domain.
  - Weak implications: the available knowledge in a domain may be incomplete and imperfect making difficult to have concrete associations between the antecedent and the consequent.
  - Imprecise language: Knowledge may be vague. For example, the rule “IF the applicant has a steady job THEN applicant is more likely to pay back the loan” contains the words “steady” and “more likely” which are vague concepts.
2. Explain any two limitations of expert systems.
  - Knowledge is not always readily available.
  - Difficult to extract expertise from humans
  - Experts may approach the same situation differently
  - Knowledge engineers are scares and expensive.
3. Explain the importance of reinforcement learning algorithms.
  - Helps in solving higher-order and complex problems. The solution obtained is very accurate.
  - Since the model learns constantly, a mistake made earlier would be unlikely to occurs in the future.
  - Various problem solving models are possible to build using reinforcement learning.
  - It is perfect because it works very similar to the human learning techniques.
4. Discuss mamdani inferencing as used in Fuzzy logics.

Mamdani fuzzy inference was first introduced as a method to create a control system by synthesizing a set of linguistic control rules obtained from experienced human operators.in mamdani system, the output of each rule is a fuzzy set.

Since mamdani systems have a more intuitive and easier to understand rule bases, they are well suited to expert system applications where the rules are created from human expert knowledge, such as medical diagnosis. The inference process of a mamdani system is described in Fuzzy Inference Process.

The output of each rule is a fuzzy set derived from the output membership function and the implication method of the Fuzzy Inferences System’s(FIS) fuzzy output are combined into a single fuzzy set using the aggregation method of the FIS.the to compute a final crisp output value, the combined output fuzzy set is defuzzied using one methods of Defuzzification methods.
5. Discuss K-NN k-nearest neighbor algorithm.

It’s one of the simplest machine learning algorithms based on supervised learning technique.it estimates the likelihood that a data point will become a member of one group or another based on what group the data point nearest to it belongs to.

It assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories.

This algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suited category by using K-NN algorithm.

6. Define the following terms
  - I. **Machine Learning:** is a type of artificial intelligence that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so.
  - II. **Machine reasoning:** is the ability to dynamically react to change and by doing this, reusing existing knowledge for new and unknown problems.
7. Explain the functions of the following parts of an expert system.
  - I. **Knowledge base:** Consists of set of rules that represents the knowledge that the system has.
  - II. **Database of facts:** Represents inputs to the system that are used to derive conclusions, or to cause actions.
8. What is the role membership value in fuzzy logics?
  - It transforms input data to 0-1 scale based on the possibility of being a member of a specified set. This value represents the degree of membership of element  $x$  in set  $A$ .
9. Name two factors that make fuzzy logics a preferred technique over expert systems.
  - Fuzzy logics capture the importance of incomplete truth
  - Fuzzy logics provide a systematic framework for dealing with fuzzy quantifiers such as most, any, few etc.
10. Contrast supervised learning from unsupervised learning.

In supervised learning, input data is provided to the model along with the output, algorithms are trained using labeled data while taking direct feedback to check it is predicting correct output or not.

In unsupervised learning only input data is provided to the model, algorithms are trained using unlabeled data without taking any feedback.