



INDIAN SCHOOL AL WADI AL KABIR

Class: X	Department: Computer Science
WORKSHEET-2	ARTIFICIAL INTELLIGENCE (417) Part B-Unit 2-Advanced Concepts of Modelling in AI

Choose the most appropriate answer for each question.

- According to the relationship between the three, which of the following statements is mathematically accurate?
A) AI is a subset of Machine Learning.
B) Deep Learning is the umbrella terminology for AI.
C) Machine Learning is a subset of Artificial Intelligence.
D) Deep Learning and Machine Learning are unrelated.
- In which type of AI modelling are the relationships or patterns in data defined explicitly by the developer?
A) Rule-based approach
B) Learning-based approach
C) Reinforcement learning
D) Deep learning
- What is the primary characteristic of a learning-based AI model?
A) It requires a specific set of programming instructions for every scenario.
B) It cannot handle changes in the original dataset.
C) The machine learns by itself and adapts to changes in data.
D) It is less advanced than a rule-based model.
- Which type of machine learning uses labelled data for training, where the desired output is already known?
A) Supervised Learning B) Unsupervised Learning C) Reinforcement Learning D) Clustering
- An AI model that uncovers hidden patterns and relationships within unlabelled data is categorized as:
A) Supervised Learning **B) Unsupervised Learning** C) Rule-based Learning D) Reinforcement Learning
- Which learning approach enables a computer to make a series of decisions by maximizing a reward metric through trial and error?
A) Classification B) Regression C) Clustering **D) Reinforcement Learning**
- If you are designing an AI model to predict the selling price of a used car based on continuous variables like years of service, which sub-category should you use?
A) Classification Model **B) Regression Model** C) Clustering Model D) Association Model
- A grading system that classifies students into discrete categories (like Grade A, B, or C) based on their marks is an example of a:
A) Classification Model B) Regression Model C) Unsupervised Model D) Reinforcement Model

9. The process of dividing unlabelled data points into different groups based on their similarities is known as:
A) Association B) Regression **C) Clustering** D) Evaluation
10. Which unsupervised learning method is used to find interesting relationships or "meaningful associations" between variables in a database, such as products often bought together?
A) Classification B) Clustering **C) Association Rule** D) Deep Learning
11. Artificial Neural Networks (ANN) are inspired by the structure and function of:
A) **The human brain and nervous system** B) Quantum computer processors
C) High-speed mathematical calculators D) Optical fiber networks
12. In a neural network, what is the role of weights and biases assigned to nodes?
A) They provide the final user interface for the output.
B) They act as the raw input data for the model.
C) They determine how strongly a node is influenced by its inputs.
D) They are only used in rule-based models.
13. Which layer of a neural network is primarily responsible for acquisition and serves as the "user-interface" for the input data?
A) Input Layer B) Hidden Layer C) Output Layer D) Calculation Layer
14. What is the main function of the Output Layer in a neural network?
A) It performs complex computations using weights and biases.
B) It cleans and pre-processes the raw data.
C) It acquires the final processed data and presents it to the user.
D) It extracts data features automatically.
15. Which of the following is true regarding Deep Learning (DL)?
A) It is less advanced than standard Machine Learning.
B) It requires very little computational power or data.
C) It enables software to train itself using vast amounts of data.
D) It cannot be used for image recognition.

Assertion and reasoning-based questions:1Mark each

Q1. Assertion: Unsupervised Learning is a type of learning without any guidance.

Reasoning: Unsupervised learning models work on unlabeled datasets, where the data fed into the machine is random and the person training the model may not have any prior information about it.

Options:

- (a) Both A and R are true and R is the correct explanation for A**
(b) Both A and R are true and R is not the correct explanation for A
(c) A is True but R is False
(d) A is false but R is True

Q2. Assertion (A): Information processing in a neural network relies on weights and biases assigned to nodes.

Reasoning (R): These weights and biases determine how strongly a node is influenced by its inputs and its overall contribution to the next layer.

Options:

- (a) Both A and R are true and R is the correct explanation for A
- (b) Both A and R are true and R is not the correct explanation for A
- (c) A is True but R is False
- (d) A is false but R is True

Answer the following questions:2 marks each

Q1. Give difference between rule based and learning based AI models.

Rule-based approach	Learning-based approach
In this approach, the machine follows rules or instructions mentioned by the developer.	In this approach, the machine learns by itself.
In this approach, AI is achieved through rule-based techniques.	In this approach, AI is achieved through the machine learning technique.
The machine once trained, doesn't take into consideration any changes made in the original dataset.	This type of approach facilitates the acquisition of new knowledge.

Q2. What is Supervised Learning? Provide a real-world example.

Answer: Supervised learning is a method where a model predicts future outcomes based on past data that is already "labeled" with the desired output. A practical example is an **email spam filter** that has been trained on a dataset of emails labeled as "spam" or "not spam" to identify and categorize new incoming messages.

Q3. Explain the difference between Classification and Regression models.

Answer: A Classification model is used when the output or "target variable" is categorical, meaning it assigns data into discrete, predefined classes like "Yes/No" or "Cat/Dog". A **Regression model** is used to predict continuous valued outputs, such as forecasting the weather for the next 24 hours or predicting the selling price of a house.

Q4. What is Clustering, and how does it differ from Classification?

Answer: **Clustering** is an unsupervised learning algorithm that identifies patterns and groups unlabeled data points into clusters based on their similarities.

Classification, however, is a directed or supervised approach where the machine is trained on labeled data to assign new inputs into specific, existing categories.

Q5. Briefly describe the functions of the three main layers in an Artificial Neural Network.

Answer: The **Input Layer** acts as the user-interface that acquires the data fed into the system; the **Hidden Layer** is where the actual processing happens as nodes use weights and biases to extract features; and the **Output Layer** is responsible for presenting the final result or processed data to the user

Answer the following questions:4 marks each

Q1 . What is supervised, unsupervised and reinforcement learning? Explain with examples.

- **Supervised learning:** Supervised learning predicts future outcomes based on past data with known labels.

Example: Imagine you're teaching a computer to recognize different fruits. You show it pictures of apples, bananas, and oranges along with labels. The computer learns to associate features (like shape, color) with the correct fruit.

- **Unsupervised learning:** Unsupervised learning uncovers patterns in data without known labels to classify future outcomes.

Example: Consider a collection of various fruits mixed together without labels.

Through clustering, the model groups similar fruits together based on their features, even though it doesn't know their names.

- **Reinforcement learning:** Reinforcement learning uses trial and error to improve decision-making over time.

Example: Teaching a computer to play chess is a classic example. The model makes moves, receives feedback (win/loss/draw), and learns over time which moves lead to success.

Q2. What is clustering and how is it different from classification?

Clustering is an example of an unsupervised learning algorithm. Clustering groups data into clusters based on similarities without predefined labels. This is useful for discovering natural groupings within data, such as grouping customers with similar purchasing behaviours for targeted marketing strategies.

Classification is an example of a directed machine learning approach. Classification involves assigning data into predefined categories based on specific attributes. For example, using algorithms trained on labeled data, emails can be classified as 'spam' or 'not spam'.

Q3. Explain neural networks. Also give functions of three layers of neural networks.

Neural networks are loosely modelled after how neurons in the human brain behave.

A neural network is essentially a system of organizing machine learning algorithms to perform certain tasks. It is a fast and efficient way to solve problems for which the dataset is very large, such as in images.

Functions of three layers of neural networks:

Neural Network consists of an input layer, hidden layer which performs computation using weights and biases on each node and finally, information is passed through these layers to reach the output layer.

- 1.The first layer of a Neural Network is known as the **input layer**. The job of an input layer is to acquire data and feed it to the Neural Network. No processing occurs at the input layer.
- 2.The **Hidden layers** are the layers in which the whole processing occurs. Each node of these hidden layers has its own machine learning algorithm which it executes on the data received from the input layer. The hidden layer performs computation by means of weights and biases. Information passes from one layer to the other after the value found from this calculation passed through a selected activation function.
- 3.The **Output layer** does not process the data which it acquires. It is meant for user-interface.

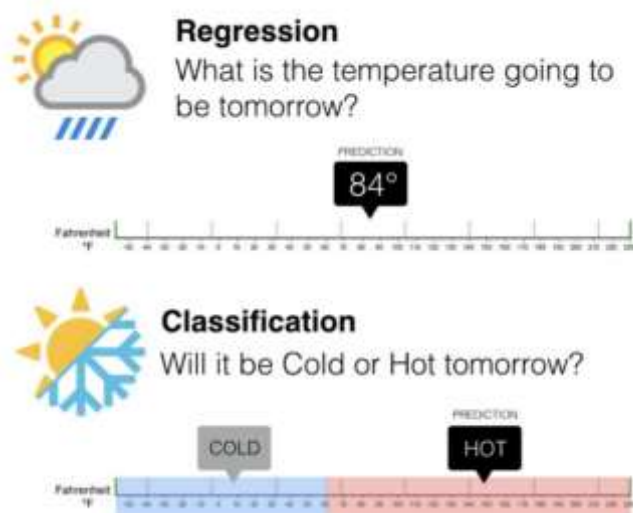
Q4. Differentiate between regression and classification model.

Regression finds correlations between dependent and independent variables.

Therefore, regression algorithms help predict continuous variables such as house prices, market trends, weather patterns, oil and gas prices, etc.

On the other hand, **Classification** is an algorithm that finds functions that help divide the dataset into classes based on various parameters. When using a Classification algorithm, a computer program gets taught on the training dataset and categorizes the data into various categories depending on what it learned.

Example:



Competency Based Questions:

Scenario: A healthcare startup is developing four AI solutions to assist doctors and administrators:

- **System A:** Predicts the **number of hours** a surgery will last based on historical surgical data and complexity factors.
- **System B:** Scans patient feedback forms and labels them as either "**Satisfied**" or "**Unsatisfied**".
- **System C:** Processes thousands of **unlabeled** patient records to find natural groupings based on similar symptoms to identify potential unknown disease outbreaks.
- **System D:** A physical therapy robot that learns the best way to support a patient's movement by receiving **rewards** for successful assistance and **penalties** for incorrect pressure.

Questions:

1. Identify the specific **Supervised Learning sub-category** used in **System A** and **System B**. (1 Mark)
2. Name the type of machine learning used in **System C** and **System D**, and explain the primary difference in how they learn. (2 Marks)
3. Why is System B categorized as a **Learning-based approach** instead of a **Rule-based approach**? (1 Mark)

Answer Key and Marking Scheme

1. **System A: Regression Model** (because it predicts a continuous valued output, such as time). **System B: Classification Model** (because it assigns data into predefined discrete categories/labels). *(0.5 Mark for each correct identification)*
2. **System C: Unsupervised Learning (Clustering). System D: Reinforcement Learning.**
Difference: System C discovers patterns and trends within **unlabelled datasets** without any explicit guidance. In contrast, System D learns through a **reward mechanism** (trial and error), where the machine receives feedback (rewards/penalties) for its actions to optimize its performance over time. *(0.5 Mark for each name + 1 Mark for the primary difference)*
3. System B is a **Learning-based approach** because the machine **learns by itself** and discovers patterns from the data fed to it, making it adaptive to changes and capable of handling exceptions. A **Rule-based approach** would be **static** and limited to specific instructions or keywords defined by a developer; it would fail to learn from its mistakes or adapt if the language in the feedback forms changed. *(1 Mark for explaining adaptation/self-learning vs. static developer-defined rules)*