1. What is the concept of human learning? Please give two examples.

Human learning is the process by which individuals acquire knowledge, skills, and behaviours through experience, study, and interaction. It involves the assimilation of information, often leading to a change in behaviour or the ability to perform tasks more effectively. Examples include learning to ride a bicycle through practice and learning a new language by exposure and study.

2. What different forms of human learning are there? Are there any machine learning equivalents?

Supervised Learning (Human Equivalent: Guided Learning): In supervised learning, the algorithm is trained on a labelled dataset, similar to how a teacher guides a student by providing labelled examples. The algorithm learns to map input to output.

Unsupervised Learning (Human Equivalent: Self-Discovery): Unsupervised learning involves discovering patterns and relationships within data without labelled guidance, akin to individuals exploring and finding connections on their own.

Reinforcement Learning (Human Equivalent: Trial and Error): Reinforcement learning involves learning through interaction with an environment, receiving rewards (positive reinforcement) or penalties (negative reinforcement) based on actions taken. This is comparable to learning through trial and error.

3. What is machine learning, and how does it work? What are the key responsibilities of machine learning?

Machine learning is a subset of artificial intelligence that focuses on the development of algorithms allowing systems to learn and improve from experience. Key responsibilities include:

Data Preparation: Collecting and preparing relevant data for training and testing.

Model Training: Using algorithms to train models on the provided data.

Model Evaluation: Assessing the performance of the trained model.

Prediction/Inference: Making predictions or decisions based on new, unseen data.

4. Define the terms "penalty" and "reward" in the context of reinforcement learning.

Reward: In reinforcement learning, a reward is a positive reinforcement given to the agent for taking a particular action. Rewards encourage the agent to learn the optimal behavior.

Penalty: A penalty is a negative reinforcement or cost associated with certain actions. Penalties discourage undesirable actions, guiding the agent toward more optimal decision-making.

5. Explain the term "learning as a search"?

Concept: Learning as a search refers to the process of exploring and searching through a space of possible solutions or hypotheses to find the one that best fits the given data or task.

Example: In machine learning, the search involves finding the optimal set of model parameters that minimizes a cost function, guiding the model toward better performance.

6. What are the various goals of machine learning? What is the relationship between these and human learning?

Prediction: Predicting future outcomes based on historical data.

Pattern Recognition: Identifying and understanding patterns within data.

Classification: Assigning data points to predefined categories.

Clustering: Grouping similar data points together.

Relationship: These goals align with aspects of human learning, where individuals predict, recognize patterns, categorize information, and group related concepts.

7. Illustrate the various elements of machine learning using a real-life illustration.

Example: Predicting House Prices

Elements:

Dataset: Historical data on house features and prices.

Model Training: Using regression algorithms to learn the relationship between features and prices.

Model Evaluation: Assessing the model's accuracy on a test set.

Prediction: Making predictions on new, unseen houses.

8. Provide an example of the abstraction method.

Example: Image Recognition

Abstraction Method: Focusing on key features like edges, shapes, and colors rather than processing every pixel.

Benefit: Reduces computational complexity while retaining essential information for classification.

9. What is the concept of generalization? What function does it play in the machine learning process?

Definition: Generalization refers to a model's ability to perform well on new, unseen data not used during training.

Function: It ensures that the model has learned underlying patterns rather than memorizing the training data, promoting adaptability to diverse scenarios.

What is classification, exactly? What are the main distinctions between classification and regression?

Classification: Classifying data into predefined categories or classes (e.g., spam or not spam).

Regression: Predicting a continuous numerical output based on input features (e.g., predicting house prices).

Distinction: Classification involves discrete outputs, while regression involves continuous outputs.

11. What is regression, and how does it work? Give an example of a real-world problem that was solved using regression.

Definition: Regression involves predicting a continuous numerical output.

Example: Predicting the price of a house based on features such as size, location, and number of bedrooms.

12. Describe the clustering mechanism in detail.

Definition: Clustering involves grouping similar data points together based on shared characteristics.

Example: Customer Segmentation – Grouping customers with similar purchasing behavior.

13. Make brief observations on two of the following topics:

Machine Learning Algorithms in Use: Diverse algorithms, such as decision trees, support vector machines, and neural networks, are used for various tasks, showcasing the versatility of machine learning.

Supervised and Unsupervised Learning: Supervised learning requires labeled data for training, while unsupervised learning discovers patterns without labeled guidance.