Assignment: Machine Learning Basic

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1. Supervised Machine Learning

Definition: Supervised learning is a type of machine learning where the model is trained on a labeled dataset. This means that each training example is paired with an output label. The goal is for the model to learn to predict the output labels from the input data.

Example: Suppose we want to build a system that can predict the price of a house based on its features such as size, location, number of bedrooms, etc. We can create a dataset where each example is a house, and each house has features (size, location, etc.) and a label (the price).

Steps:

- **Training:** The model is trained on a dataset where the features and corresponding prices are known.
- **Prediction:** After training, the model can predict the price of a new house based on its features.

2. Unsupervised Machine Learning

Definition: Unsupervised learning involves training a model on data that has no labeled responses. The model tries to learn the patterns and the structure from the data without any specific output variable to predict.

Example: Clustering customer data. Suppose a retail store wants to understand its customers better without having specific labels (e.g., customer type). The store can use unsupervised learning to find patterns in the customer data, such as clustering customers into groups based on their purchasing behavior.

Steps:

- **Data:** Collect data on customers, such as purchase history, amount spent, frequency of visits, etc.
- **Clustering:** Use an algorithm like K-means to cluster the customers into groups based on their behavior.

3. Reinforcement Learning

Definition: Reinforcement learning is a type of machine learning where an agent learns to make decisions by performing actions in an environment to maximize some notion of cumulative reward. The agent learns through trial and error, receiving feedback from its actions in terms of rewards or penalties.

Example: Training a robot to navigate a maze. The robot (agent) needs to learn the best path to get out of the maze (goal) by trying different paths and receiving feedback (reward or penalty) based on its actions (moving through the maze).

Steps:

- **Environment:** The maze.
- **Agent:** The robot.
- **Actions:** Movements like move forward, turn left, or turn right.
- **Rewards:** Positive reward for moving closer to the exit and negative reward for hitting walls or moving away from the exit.

4. Classification vs Regression vs Clustering

Classification:

- **Definition:** A supervised learning task where the goal is to predict a categorical label.
- **Example:** Email spam detection (spam or not spam). Each email is classified into one of two categories.

Regression:

- **Definition:** A supervised learning task where the goal is to predict a continuous value.
- **Example:** Predicting house prices. The output is a real-valued number representing the price.

Clustering:

- **Definition:** An unsupervised learning task where the goal is to group a set of objects in such a way that objects in the same group (cluster) are more similar to each other than to those in other groups.
- **Example:** Customer segmentation. Customers are grouped into clusters based on similarities in their purchase behavior, without pre-defined labels.

Type of Learning	Goal	Example	Labels	Output Type
Supervised	Predict labels	House price prediction	Yes	Categorical (classification) or Continuous (regression)
Unsupervised	Find patterns	Customer segmentation	No	Groupings (clusters)
Reinforcement	Maximize reward	Robot navigating maze	No	Sequence of actions leading to rewardv