

Machine Learning – Detailed Answers

1. Machine Learning and Its Rapid Growth

Machine Learning (ML) is a branch of artificial intelligence that enables systems to learn from data and improve performance without being explicitly programmed. Instead of following fixed rules, ML systems identify patterns from data and make predictions or decisions.

The machine learning trend is emerging rapidly due to the availability of large volumes of data, powerful computing resources, cloud platforms, and advancements in algorithms. Businesses increasingly rely on ML for automation, personalization, and intelligent decision-making.

2. Types of Machine Learning Algorithms

Machine learning algorithms are broadly classified based on the type of learning and data used.

- Supervised Learning – Learns from labeled data (e.g., classification, regression).
- Unsupervised Learning – Works with unlabeled data to find hidden patterns.
- Semi-Supervised Learning – Uses a mix of labeled and unlabeled data.
- Reinforcement Learning – Learns by interacting with an environment using rewards and penalties.

3. Difference between Classification and Regression

- Classification predicts categorical outputs.
- Regression predicts continuous numerical values.
- Classification examples: spam detection, disease diagnosis.
- Regression examples: price prediction, temperature forecasting.
- Classification uses accuracy as metric.
- Regression uses metrics like MSE and RMSE.

4. Reinforcement Learning and Its Learning Models

Reinforcement Learning (RL) is a machine learning technique where an agent learns by interacting with an environment. The agent performs actions and receives rewards or penalties based on those actions.

- Model-Based Learning – Agent builds a model of the environment.
- Model-Free Learning – Agent learns directly from experience.
- Value-Based Learning – Learns value of actions (e.g., Q-learning).
- Policy-Based Learning – Learns optimal policy directly.

5. Difference between Reinforcement Learning and Supervised Learning

- Supervised learning uses labeled data; reinforcement learning uses rewards.

- Supervised learning learns from examples; reinforcement learning learns from interaction.
- Supervised learning has direct feedback; reinforcement learning has delayed feedback.
- Reinforcement learning focuses on sequential decision-making.
- Supervised learning is simpler to implement.