

Traditional Machine Learning vs Neural Networks: Key Differences and Advantages of Deep Learning

Machine Learning (ML), a core part of Artificial Intelligence (AI), allows computers to learn from data and improve their behavior over time without explicit instructions. ML algorithms create mathematical representations from data to:

- Identify patterns and trends
- Make predictions or classify information
- Automate decision-making processes

Categories of Machine Learning:

- **Supervised Learning:** Uses labeled data to train models (e.g., recognizing spam emails)
- **Unsupervised Learning:** Finds hidden structures in unlabeled data (e.g., grouping customers by behavior)
- **Reinforcement Learning:** Learns optimal actions through feedback and rewards (e.g., AI game agents)

A **Neural Network** is a computational framework inspired by biological neural systems, consisting of layers of interconnected units called neurons. Each neuron applies weights, biases, and activation functions to input data. Networks are trained by adjusting these weights via backpropagation to minimize errors.

The basic form, known as a **Multi-Layer Perceptron (MLP)**, can approximate complex, nonlinear functions, surpassing simpler models.

Deep Learning (DL) refers to machine learning approaches that use neural networks with many hidden layers, providing:

- The ability to automatically learn important features from raw data
- Efficient handling of very large datasets
- Superior performance in challenging tasks such as image and speech recognition, and natural language understanding