

INTRODUCTION TO DEEP LEARNING AND NEURAL NETWORK

What is Deep Learning?

Deep learning is a subset of **machine learning** where algorithms are inspired by the structure and function of the brain, specifically neural networks. These algorithms are designed to automatically learn patterns from data by layering computations.

In traditional machine learning, you might have to manually design features or rules. Deep learning, on the other hand, **automates this feature extraction process**, which makes it powerful for tasks like image recognition, speech processing, and language translation.

The Role of Neural Networks

At the core of deep learning are **artificial neural networks (ANNs)**. These are computational systems inspired by the way biological neurons work. Neural networks are made up of:

1. **Input Layer:** Where the raw data enters the system.
2. **Hidden Layers:** Layers of neurons that transform inputs into more abstract representations.
3. **Output Layer:** Where the final prediction or result is produced.

For example, in image recognition:

- The input might be pixel values of an image.
- The hidden layers detect edges, shapes, and objects.
- The output layer classifies the image, such as "cat" or "dog."

Workflow of neural network:

Input Data --> Forward Propagation --> Predictions --> Loss Calculation -->
Backpropagation --> Gradient Updates --> Adjust Parameters --> Repeat

✚ **Forward Propagation** is the "prediction phase" where the model computes outputs.

✚ **Backpropagation** is the "learning phase" where the model adjusts itself.

✚ This **iterative** life cycle allows the network to improve its predictions over time, eventually generalizing well to unseen data.