

## Introduction

Deep Learning is a subset of ML focused on artificial neural networks with many layers (deep architectures). It mimics the structure and functioning of the human brain, enabling systems to process vast amounts of unstructured data.

## Key Concepts

1. **Neural Networks:** Composed of interconnected nodes (neurons) organized into layers.
2. **Convolutional Neural Networks (CNNs):** Specialized for image recognition.
3. **Recurrent Neural Networks (RNNs):** Ideal for sequential data like time series and text.

## Milestones in Deep Learning

- **AlexNet (2012):** Revolutionized image recognition with CNNs.
- **AlphaGo (2016):** DeepMind's AI defeated human champions in the game of Go.
- **GPT-3 (2020):** A language model capable of generating human-like text.

## Applications

1. **Autonomous Driving:** Deep learning models process visual data to identify objects and make driving decisions.
2. **Natural Language Processing (NLP):** Advanced chatbots and virtual assistants.
3. **Healthcare:** Deep learning accelerates drug discovery by predicting molecular interactions.

## Challenges

- **Computational Cost:** Deep learning requires significant computational resources.
- **Data Dependency:** Models need vast amounts of labeled data for training.