

Deep learning





## Learning Content:

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## What is AI

Even the most **complex behaviors** shown by insects are never taken into consideration when **attempting to determine** whether or not they are intelligent, yet everything but the simplest **human behaviors are attributed to intelligence.**

## Types of AI

**Types of AI (based on functionality):**

- 1. Reactive Machines**
- 2. Limited Memory**
- 3. Theory of Mind**
- 4. Self-Aware**

**Types of AI (based on technology):**

- 1. Artificial Narrow Intelligence (ANI)**
- 2. Artificial General Intelligence (AGI)**
- 3. Artificial Super Intelligence (ASI)**

## What is Deep Learning

**Deep learning** is a subset of **AI's machine learning**. Artificial intelligence lets **computers replicate human behavior**. Machine learning uses **data-trained algorithms** to do all this. Deep learning is **inspired by the human brain's structure**.

## **Types of Deep Learning:**

1. Artificial Neural Networks (ANN)
2. Convolution Neural Networks (CNN)
3. Recurrent Neural Networks (RNN)

## Difference Between ML VS DL:

1. Feature extraction
2. Feature selection



## How we can Understand Deep Learning easily?

Deep learning is based on the idea of gleaning or extracting features from raw data by the application of **numerous layers** of analysis, each of which focuses on a distinct facet of the data that was provided as input. **Convolutional networks**, **recurrent neural networks**, and **deep neural networks** are examples of the several types of deep learning approaches.



What is **prerequisite** of Deep Learning?

1. Programming
2. Statistics
3. Calculus
4. Linear Algebra
5. Probability
6. Data Science

# Statistics

- Population
  - Sample
  - Mean
  - Median
  - Mode
  - Variance
  - Standard Deviation
  - Range
  - Inferential Statistics
  - Descriptive Statistics
  - Skewness
  - Distribution
- Inter Quartile Range (IQR)
    - Q1: middle value in the first half of the ordered data points
    - Q2: median of the data points
    - Q3: middle value in the second half of the ordered data points
    - IQR: given by  $Q3 - Q1$
  - Central Limit Theorem (CLT)
  - Hypothesis Testing
    - Null Hypothesis ( $H_0$ )
    - Alternate Hypothesis ( $H_A$ )

## Importance of mathematics

The importance of mathematics to machine learning may be attributed to a number of different factors. Listed below are some of them:

1. Choosing the appropriate method requires taking into account a variety of factors, including accuracy, training duration, model complexity, the number of parameters, and the number of features.
2. Choosing parameter settings and validation techniques.
3. By having a grasp of the bias-variance tradeoff, one may determine if a model is underfitting or overfitting.
4. Getting an accurate estimate of the confidence interval and the amount of uncertainty.



# Linear Algebra

## 1. Scalars

- A scalar is just a single number, in contrast to most of the other objects studied in linear algebra, which are usually **arrays of multiple numbers**.

## 2. Vectors:

- A vector is an **array of numbers**.

## 3. Matrices:

- A matrix is a **2-D array of numbers**, so each element is identified by two indices instead of just one.

## 4. Tensors:

- In some cases we will need an array with **more than two axes**.

# Probability

- **Theoretical** Probability
- **Experimental** Probability
- **Axiomatic** Probability

# **Applications** of Deep Learning

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- Virtual Assistants
- Healthcare
- Entertainment
- News Aggregation and Fake News Detection
- Image Coloring
- Robotics
- Image Captioning
- Self Driving Cars
- Natural Language Processing
- Visual Recognition
- Fraud Detection
- Personalisations
- Detecting Developmental Delay in Children
- Colourisation of Black and White images
- Adding Sounds to Silent Movies
- Automatic Machine Translation
- Automatic Handwriting Generation
- Automatic Game Playing
- Language Translations
- Pixel Restoration
- Demographic and Election Predictions
- Deep Dreaming