

Deep Learning Complete notes: Day 1

What is Deep Learning?

Definition:

- a) DL is a subfield of Artificial Intelligence and ML that is inspired by the structure of a human brain.
- b) A type of machine learning based on artificial neural networks in which multiple layers of processing are used to extract progressively higher level features from data.

ML uses Statistical techniques while DL Analyzes data with logical structures called neural networks.

Types

1. Artificial Neural Networks (ANN): The simplest form of neural networks.
2. Convolutional Neural Networks (CNN): Especially effective for image data.
3. Recurrent Neural Networks (RNN): Primarily used for sequential data such as text or speech.
4. Generative Adversarial Networks (GAN): Used for tasks like generating text or images.
5. Object Detection: Identifying and localizing objects within images.
6. Image Segmentation: Partitioning an image into multiple segments.

Perceptron

1. The perceptron is a fundamental building block of neural networks.
2. It's a mathematical model used for supervised learning problems.
3. It's a binary classifier, separating data into classes using a linear decision boundary.
4. In n-dimensional space, a perceptron in 2D is a line, in 3D it's a plane, and in higher dimensions, it's a hyperplane.

Libraries

Deep learning libraries used by companies

1. Tensor Flow
2. Keras

Deep learning libraries used by researchers

- a. Pytorch

Representation Learning

Representation Learning → Automatic feature extraction from data.

Layers Of A Neural Network:

Input Layer

we Input data from here.

Hidden layers near input

Extracts Primitive features.

Hidden layers near output

Extracts Complex features.

Deep Learning Vs Machine Learning:

Data Dependency

Deep Learning tends to perform better with more data but can be data-hungry.

Data	Performance of ML	Performance of DL
Less	Good	Bad
More	Stagnant after some time	Good

Hardware

DL typically requires more expensive hardware, such as GPUs, for training.

Model	Hardware	Hardware Type
ML	cheap	CPU
DL	Costly	GPU

Training Time

Training DL models can take weeks or even months, compared to ML models which may train faster.

Model	Training Time	Approximate time
ML	Low	Varies
DL	Costly	Few weeks or even a months

Feature Selection

DL often involves automatic feature extraction through representation learning, while in ML, feature selection is often manual.

Model	Feature Selection
ML	Manual
DL	Representation Learning

Interpretability

ML models are often more interpretable compared to DL models.

Model	Feature Selection
ML	high
DL	Not interpretable

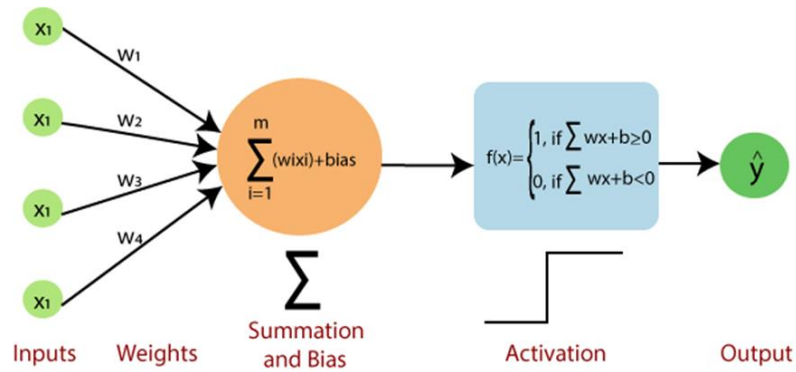
Perceptron:

1. Mathematical model or function
2. Used for supervised learning problems
3. Weighted sum is given by the equation of line $Ax+By+C=0$
4. Binary Classifier (Classifies Linear or sort of linear data)
5. Perceptron is a line which divide data into classes and create regions in space

$Ax+By+C \geq 0$	Region above the line
$Ax+By+C \leq 0$	Region below the line

Activation function

1. The activation function determines the output of a neuron given its input.
2. A step function is one type of activation function that triggers output above a certain threshold value.



Perceptron in n-dimensions:

Dimension of space	Perceptron
2D Space	Perceptron in 2D Space is a line
3D Space	Perceptron in 2D Space is a plane
above	Perceptron in higher dimensions is a hyper plane

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