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Unit-1

Fundamentals of Deep Learnings

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Objective

- Deep Learning
- Deep Neural Network
- DL Vs ML
- Forward and Back Propagation
- Multilayer Perceptron

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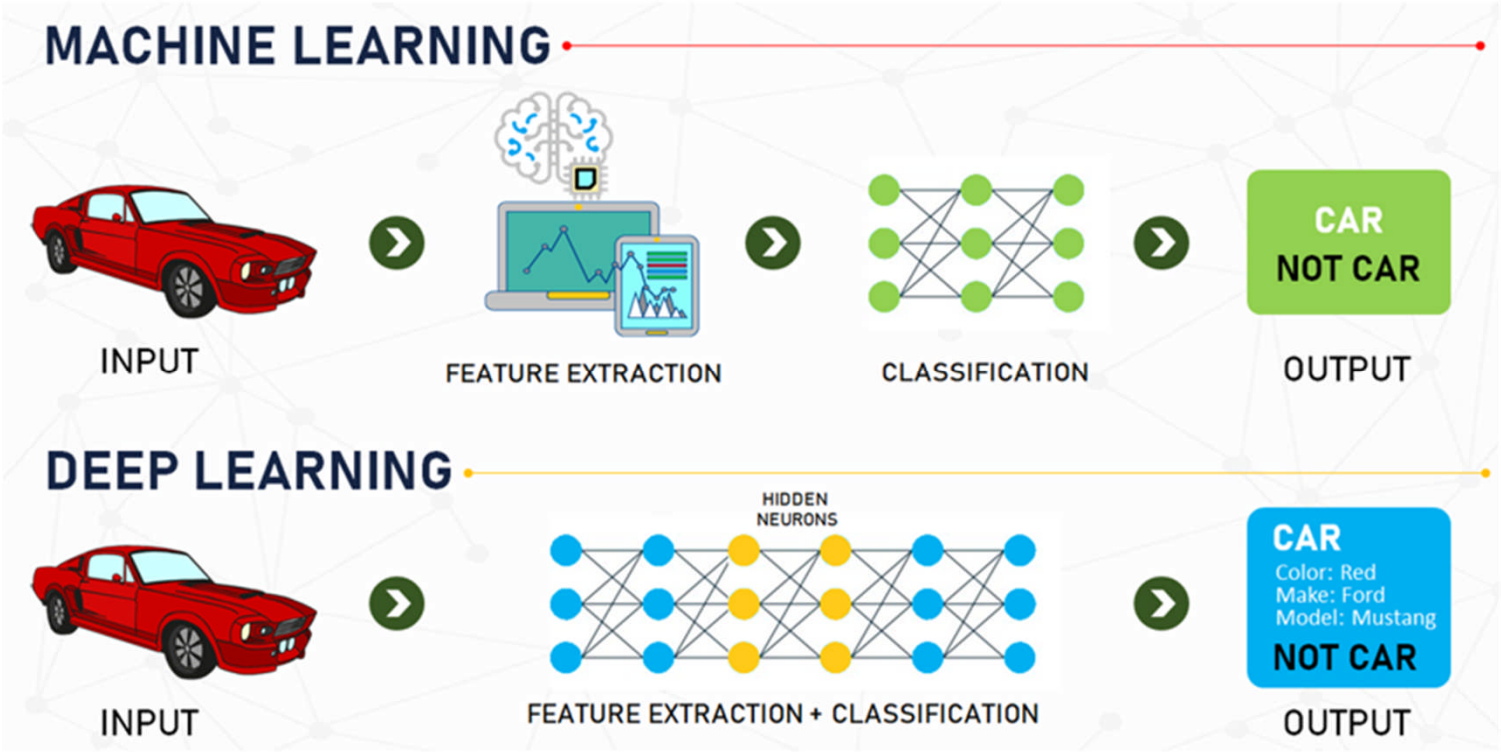
What is Deep Learning?

- Also known as deep structured learning
- Part of a broader family of machine learning methods
- Based on artificial neural networks
- Learning can be supervised, semi-supervised or unsupervised.[8]

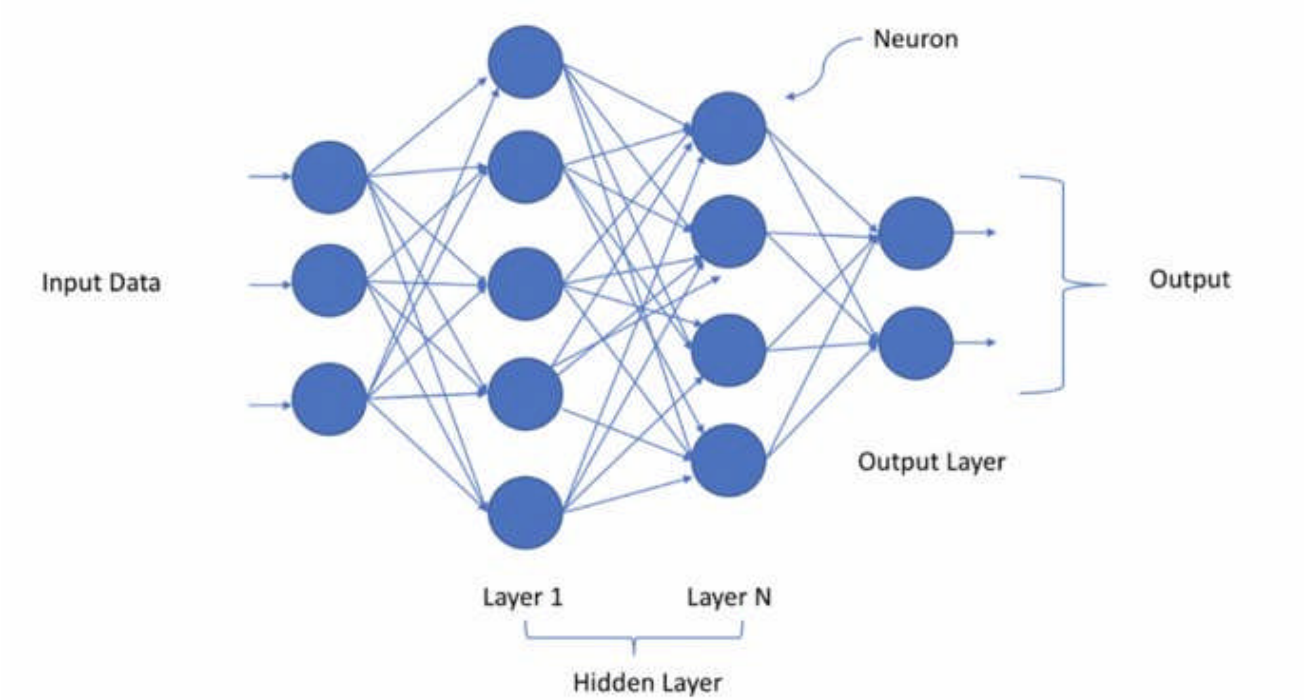
Machine Learning Vs Deep Learning



Deep Neural Networks(DNN)

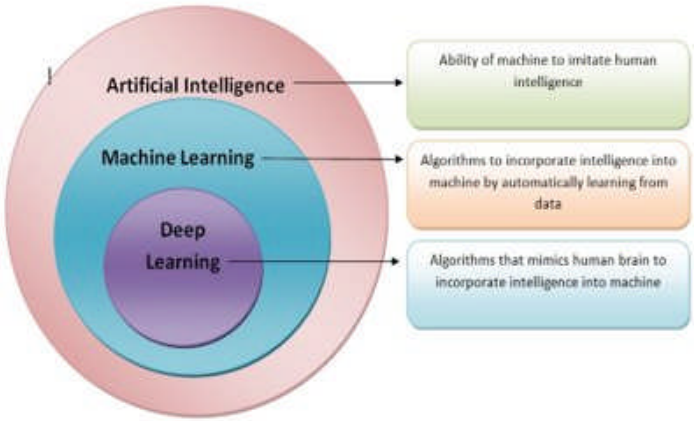
- A hierarchical organization of neurons with connections to other neurons is a simplified representation of a DNN.
- Deep Neural Networks gained their name from the fact that they utilized a lot of hidden layers to learn more intricate patterns, giving them the label "deep".
- Based on the received input, these neurons send a message or signal to other neurons, forming a complex network that learns through a feedback loop.

Representation of DNN



Advantages of DL over ML

- DL models do not require any pre-processing for feature extraction and are capable of categorizing data into multiple classes and categories on their own.
- Raw Data is given as an input to DL model.
- Pre-processed data is given to ML model.
- After a certain point, the accuracy of ML models stops rising with more data, but the accuracy of DL models continues to increase with increasing data.



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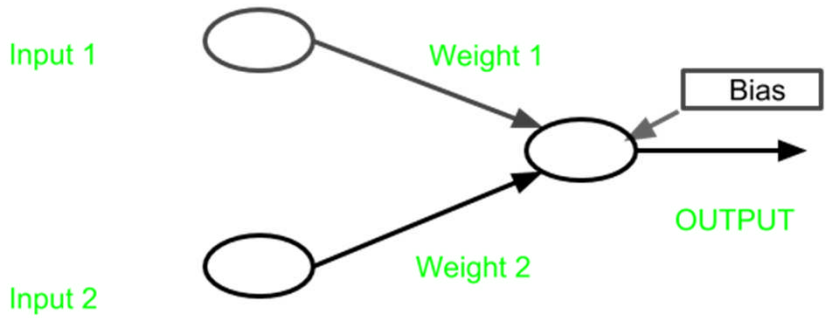
Neurons

- Neurons in deep learning models are **nodes through which data and computations flow**.
- Neurons work like this:
  - They receive one or more input signals. These input signals can come from either the raw data set or from neurons positioned at a previous layer of the neural net.
- They perform some calculations.
- They send some output signals to neurons deeper in the neural net through a synapse

Weights and Bias

- Weights enable the artificial neural network to dial up or dial down connections between neurons.
- Bias can be used to make adjustments *within* neurons. Bias can be positive or negative, increasing or decreasing a neuron's output



Output = weight1 * input1 + weight2 * input2 +bias

Forward and Backward Propagation

- Forward propagation is how neural networks make predictions. Input data is “forward propagated” through the network layer by layer to the final layer which outputs a prediction.
- Forward propagation (or forward pass) refers to the calculation and storage of intermediate variables (including outputs) for a neural network in order from the input layer to the output layer. We now work step-by-step through the mechanics of a neural network with one hidden layer.

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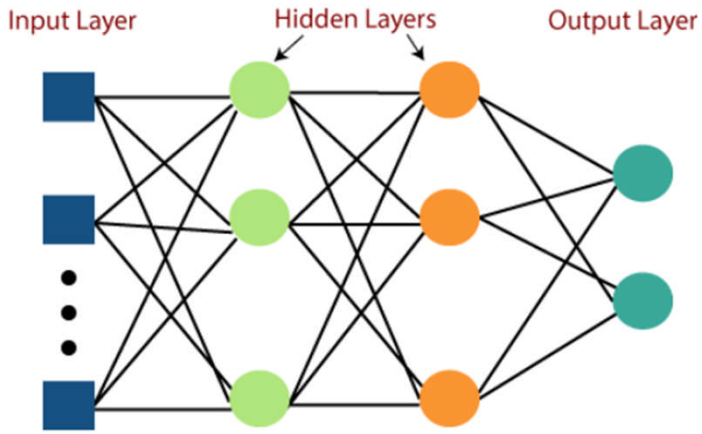
Backward Propagation

- In machine learning, backpropagation is a widely used algorithm for training feedforward neural networks. Generalizations of backpropagation exist for other artificial neural networks (ANNs), and for functions generally. These classes of algorithms are all referred to generically as "backpropagation".
- In fitting a neural network, backpropagation computes the gradient of the loss function with respect to the weights of the network for a single input–output example, and does so efficiently, unlike a naive direct computation of the gradient with respect to each weight individually.

Multilayer Perceptron

- Multilayer Perceptron is commonly used in simple regression problems. However, MLPs are not ideal for processing patterns with sequential and multidimensional data.
- MLP networks are used for supervised learning format. A typical learning algorithm for MLP networks is also called back propagation's algorithm.
- Multi-Layer perceptron defines the most complex architecture of artificial neural networks. It is substantially formed from multiple layers of the perceptron.



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Reference

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