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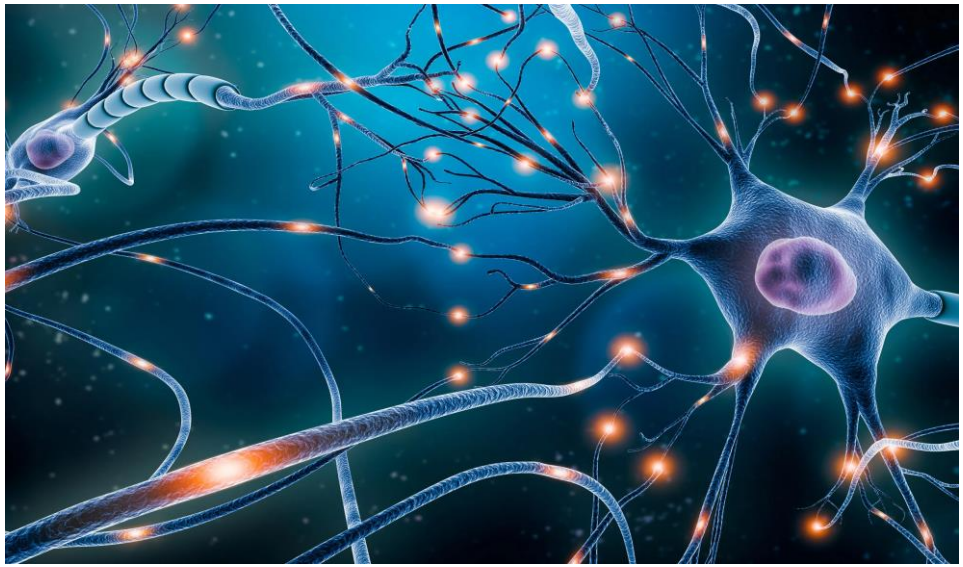
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

UNIT - 4

NEURONS AND NEURAL NETWORKS



Prepared by

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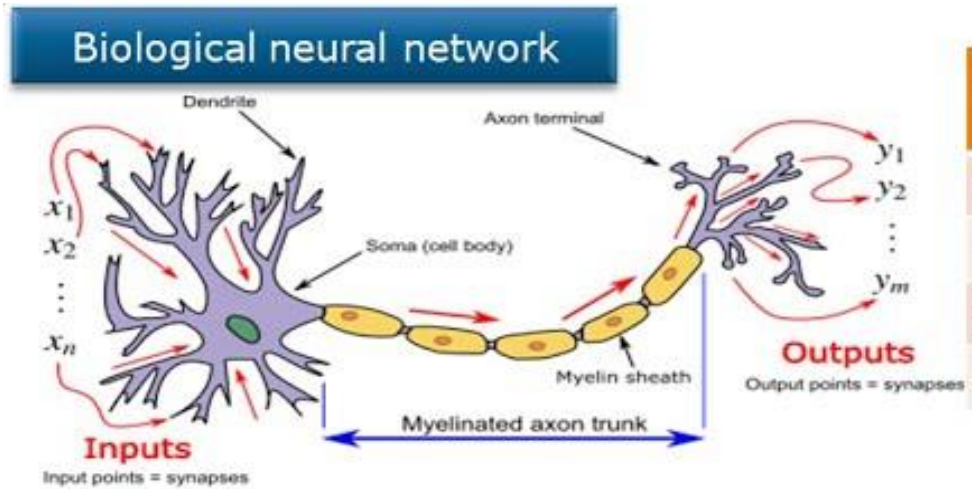
SNSCE

Biological and Artificial Neurons

- In neuroscience, a **biological neural network** is a physical structure found in brains and complex nervous systems – a population of nerve cells connected by synapses.
- In machine learning, an **artificial neural network** is a mathematical model used to approximate nonlinear functions. Artificial neural networks are used to solve artificial intelligence problems.

Neurons and Neural Networks



Biological Neuron	Artificial Neuron
Dendrites	Inputs
Cell nucleus	Nodes
Synapse	Weights
Axon	Output

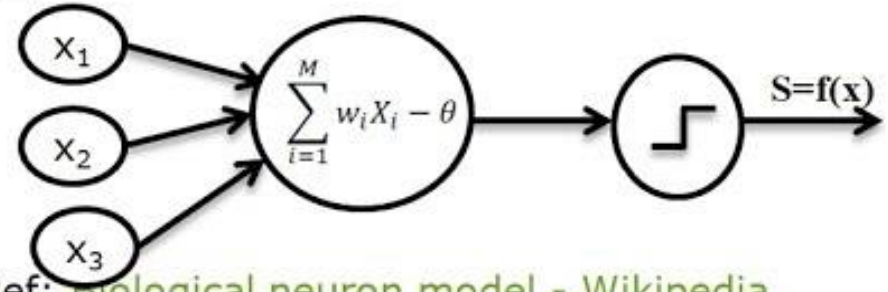


Figure Ref: Biological neuron model - Wikipedia

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- A neural network is a **machine learning** program, or model, that makes decisions in a manner **similar to the human brain**, by using processes that **mimic the way biological neurons** work together to identify phenomena, weigh options and arrive at conclusions.

  - Inspired by the **structure and function of the human brain**, artificial neural networks (ANNs) were developed.
  - These networks are composed of **interconnected artificial neurons**, or **nodes.**
  - Each neuron **receives** inputs, **processes** them using a weighted sum and an activation function, and **produces** an output.

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Neural Network Terminology

- Typically, from the biological perspective, we find neurons as part of the central nervous system and the human brain.
- **Apart from the living world, in the realm of Computer Science's Artificial Neural Networks, a** neuron is a collection of a set of inputs, a set of weights, and an activation function. It translates these inputs into a single output. Another layer of neurons picks this output as its input and this goes on and on. In essence, we can say that **each neuron is a mathematical function that closely simulates the functioning of a biological neuron**.

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- Every neural network consists of **layers of nodes**, or artificial neurons - an **input layer**, **one or more hidden layers**, and an **output layer**.
- **Each node connects to others**, and has its own associated **weight and threshold.**
- If the output of any individual node is **above the specified threshold value, that node is activated**, sending data to the next layer of the network.
- Otherwise, no data is passed along to the next layer of the network.

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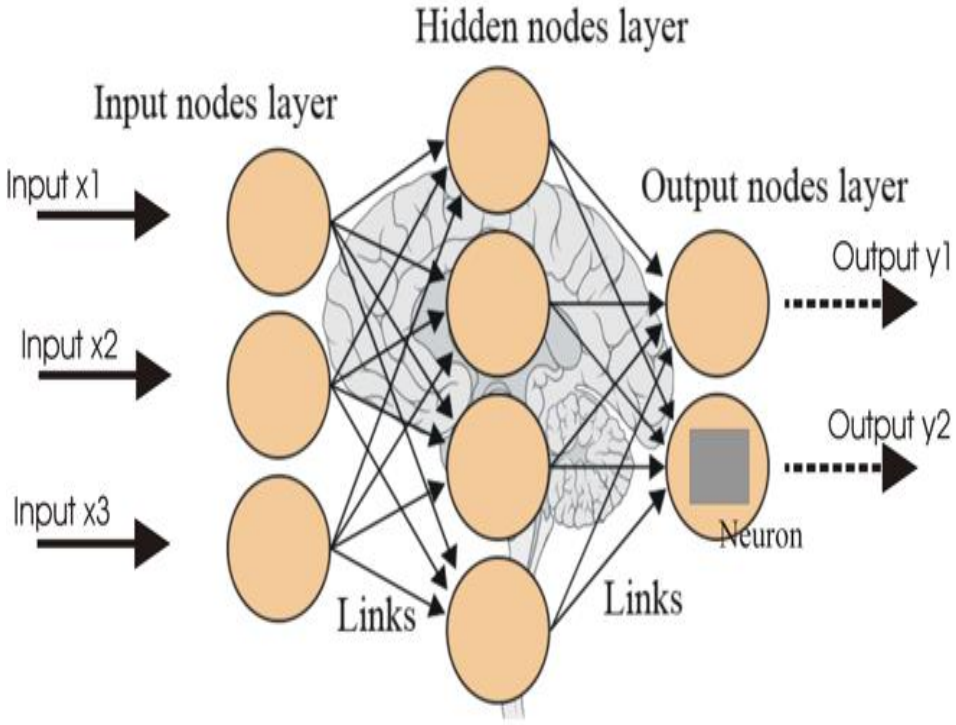
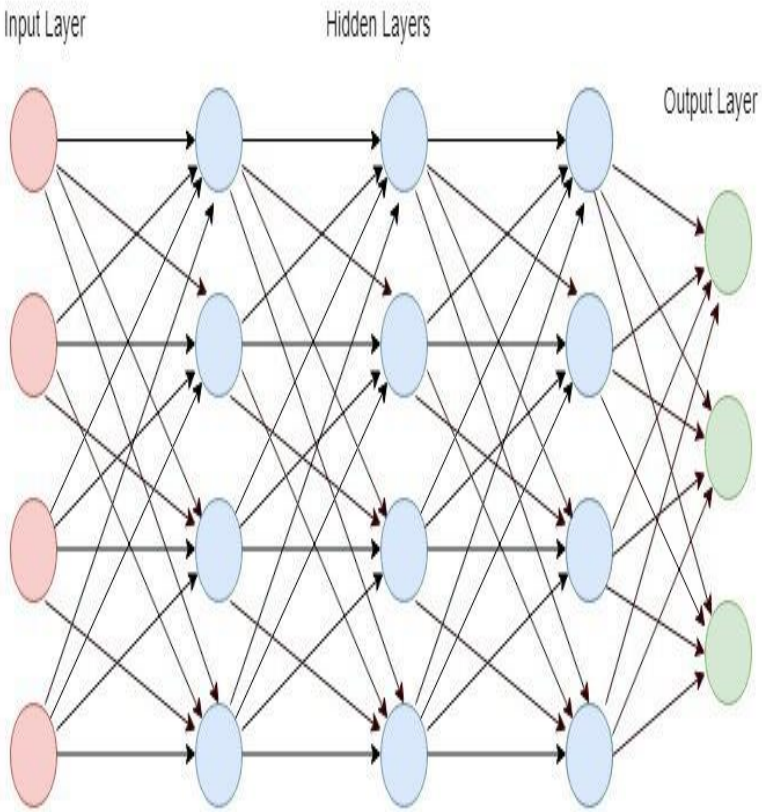

Hidden nodes layer
Input nodes layer
Input x1
Input x2
Input x3
Output nodes layer
Output y1
Output y2
Neuron
Links
Links


Input Layer
Hidden Layers
Output Layer


Thank You