



Artificial Neural Network

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ARTIFICIAL NEURAL NETWORK

Class-1 Neural Network

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Content



1. Neural Network: Human Nervous System
2. Artificial Neuron- *McCulloch-Pitts Model of Neuron*

Human Nervous System:

- The nervous system is the most complex and highly organized body system.
- It receives information from the sensory organs via nerves, transmits the information through the spinal cord, and processes it in the brain.
- Then, we perceive the information and we act/respond accordingly.

Human Nervous System:

- The human nervous system may be viewed as a three stage as depicted in the below block diagram:

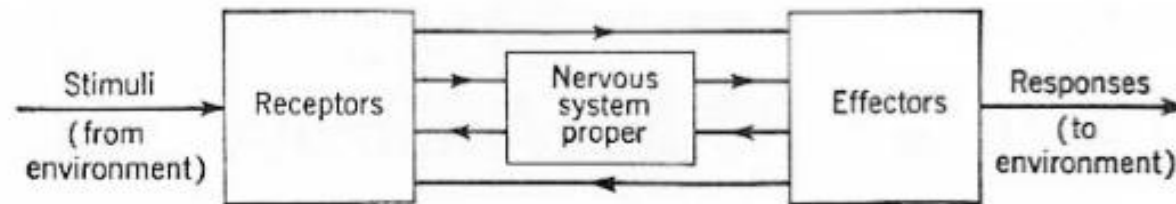
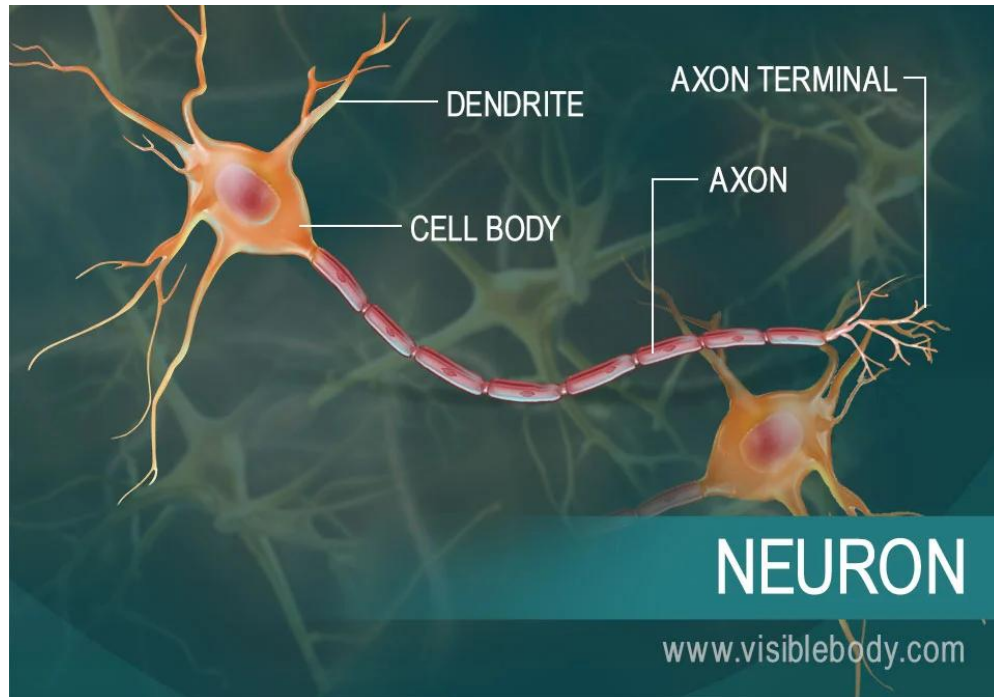


Figure The nervous system considered as a three-stage system.

Human Nervous System:

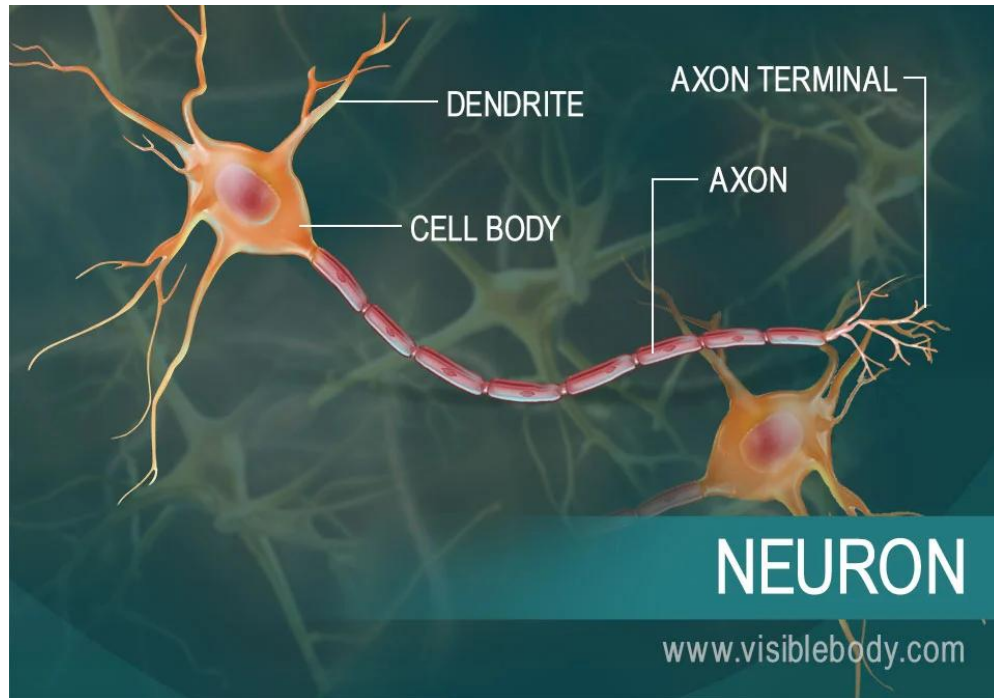
- **Receptors:** Rods and Cones of eyes, Pain, touch, hot and cold receptors of skin, Stretch receptors of muscles
- **Effectors:** Muscles and glands, speech generators
- All nervous tissue, from the brain to the spinal cord to the furthest nerve branch, includes cells called **neurons**.

Introduction



- Neurons are charged cells: they conduct **electrical signals** to **pass information** through the body
- A typical neuron consists of a cell body, dendrites, and an axon with an axon terminal.

Introduction



- **Main part** of the “**Nervous System**” is Network of Neurons .

Introduction

- The dendrites receive signals from body tissues or other neurons and pass them into the cell body.
- If an outgoing signal is produced, it zips down the axon to the axon terminal and passes to the next neuron or target cell.
- This conductive capability sends information up and down nerve pathways and through the central nervous system at incredible speed.
- Some 100 billion neurons give the brain its awesome processing power.

Idealization of a neuron:

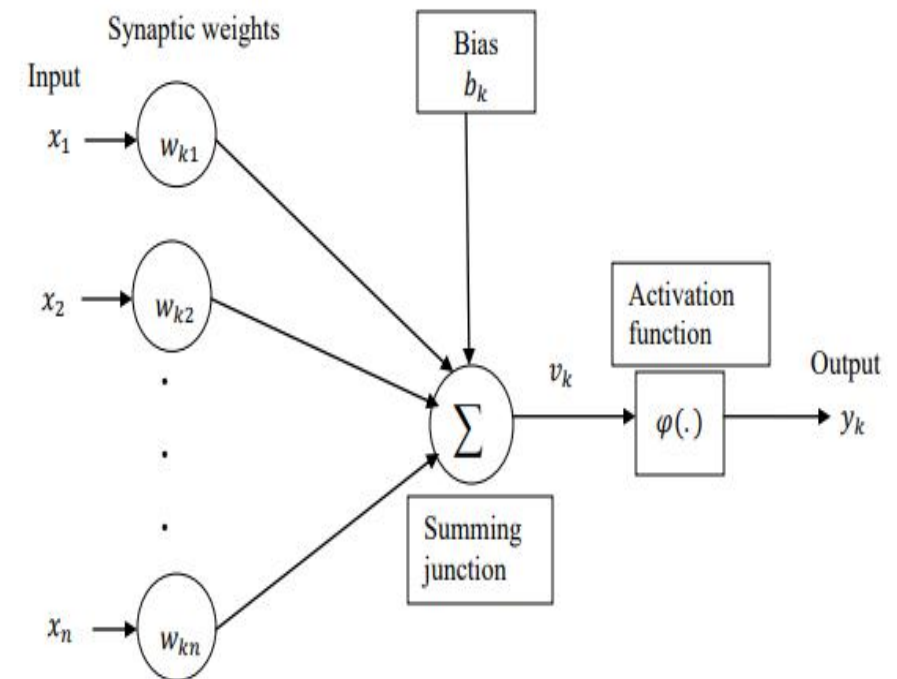
To build a network model we use the following features of the biological neuron:

- a. Inputs arrive at a neuron of varying strengths
- b. The cell body acts as a summing device to obtain the net effect of various input signals
- c. When the threshold is exceeded the neuron fires.
- d. An active synapse, which repeatedly triggers will grow in strength and other synapses weaken. Therefore the synaptic strength is modified continuously. This is called plasticity

THE ARTIFICIAL NEURON MODEL IS BUILT BASED ON THE ABOVE

Introduction

- Model of the Artificial Neuron:
- A neuron is an information-processing unit that is fundamental to the operation of a neural network
- The diagram shows the model of neuron- "*McCulloch-Pitts Model of Neuron*".
- **Three basic elements of neuronal model:**
 - Connecting links/set of synapses
 - Adder: linear combiner
 - Activation function/Squashing functions



Introduction

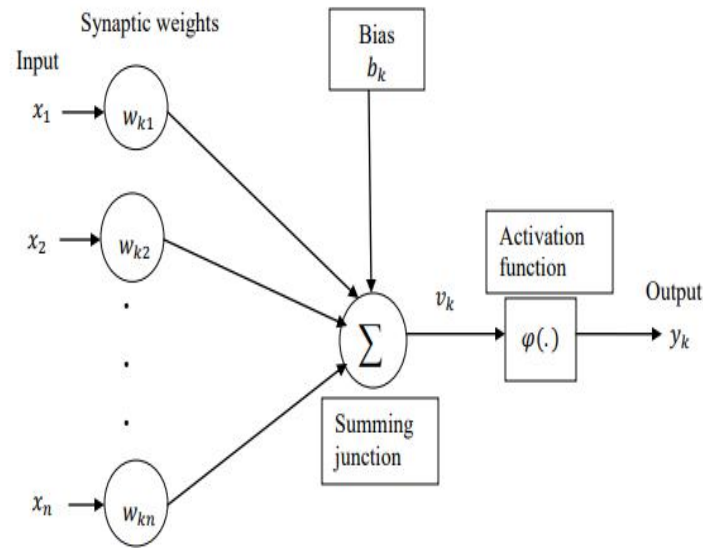
Artificial Neuron:

Let us take a look at the similarities based on the terminology between Biological and Artificial Neurons.

Biological Neuron	Artificial Neuron
Soma	Node
Dendrites	Input
Synapse	Weights or Interconnections
Axon	Output

Introduction

Mathematically a neuron 'k' can be represented as :



signals and $w_{k1}, w_{k2}, \dots, w_{km}$

Linear combiner output:

$$u_k = \sum_{j=1}^m w_{kj} x_j$$

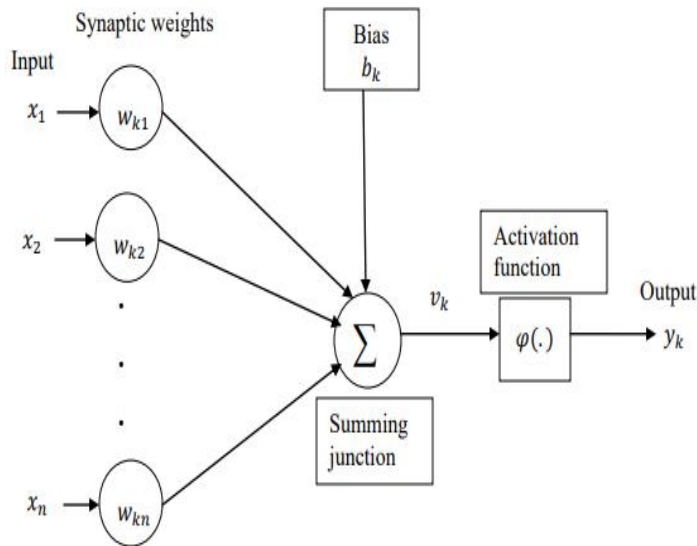
Output of a neuron:

$$y_k = \phi(u_k + b_k)$$

where, x_1, x_2, \dots, x_m are the input
are the synaptic weights, b_k is the bias

Introduction

Activation potential /Induced Local field of neuron k:



$$v_k = u_k + b_k$$

$$v_k = \sum_{j=0}^m w_{kj} x_j$$

$$y_k = \varphi(v_k)$$

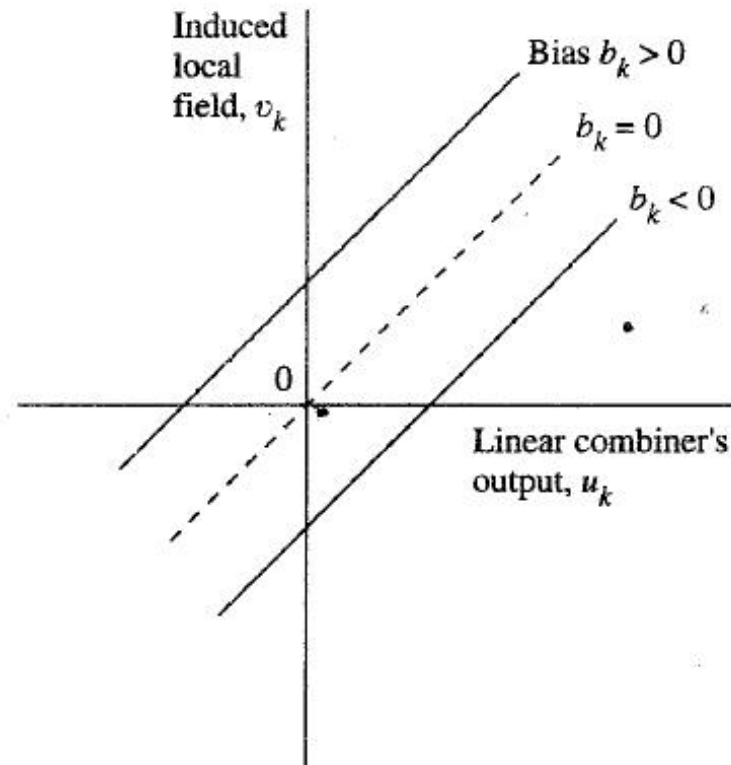
Introduction

Artificial Neural Network:

- Neural Network is a network of artificial neurons, as found in human brains, for solving artificial intelligence problems such as image identification. They may be a physical device or mathematical constructs
- In other words, Artificial Neural Network is a parallel computational system consisting of many simple processing elements connected to perform a particular task.

Introduction

The usage of bias has the effect of affine transformation



References



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- Google. com



THANK YOU

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