Fuzzy Logic & Neural Networks (CS-514)

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Introduction

What is Intelligence?

The Ability to:

- Learn,
- Understand,
- Reason,
- Plan,
- Solve Problems, and
- Adapt to New Situations.

Introduction

What is Artificial Intelligence?

An attempt to bring Intelligence into Machines through:

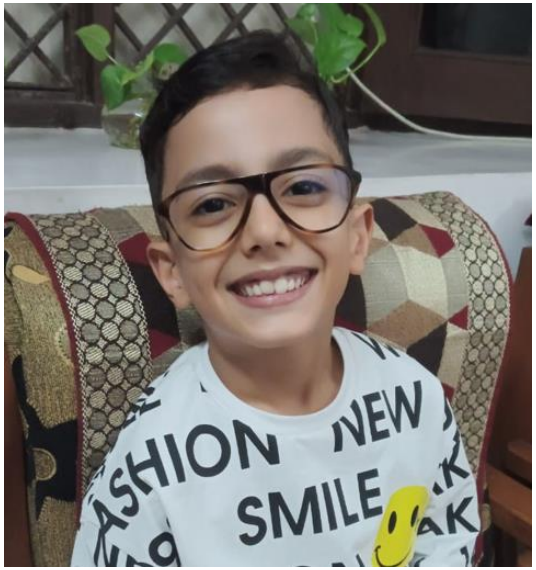
- Programming,
- Information Exchange and
- Interactions

Introduction

Why Intelligence is difficult to implement artificially ?

"Because it is unexplainable"

Example:
Who is he?



Example:
Who is he?

Source: Google Images

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What is Learning?

"The ability to retain knowledge which is gained through experience"

Introduction

What is Machine Learning?

"A type of AI that enables self learning through data and interactions without human intervention"

Introduction

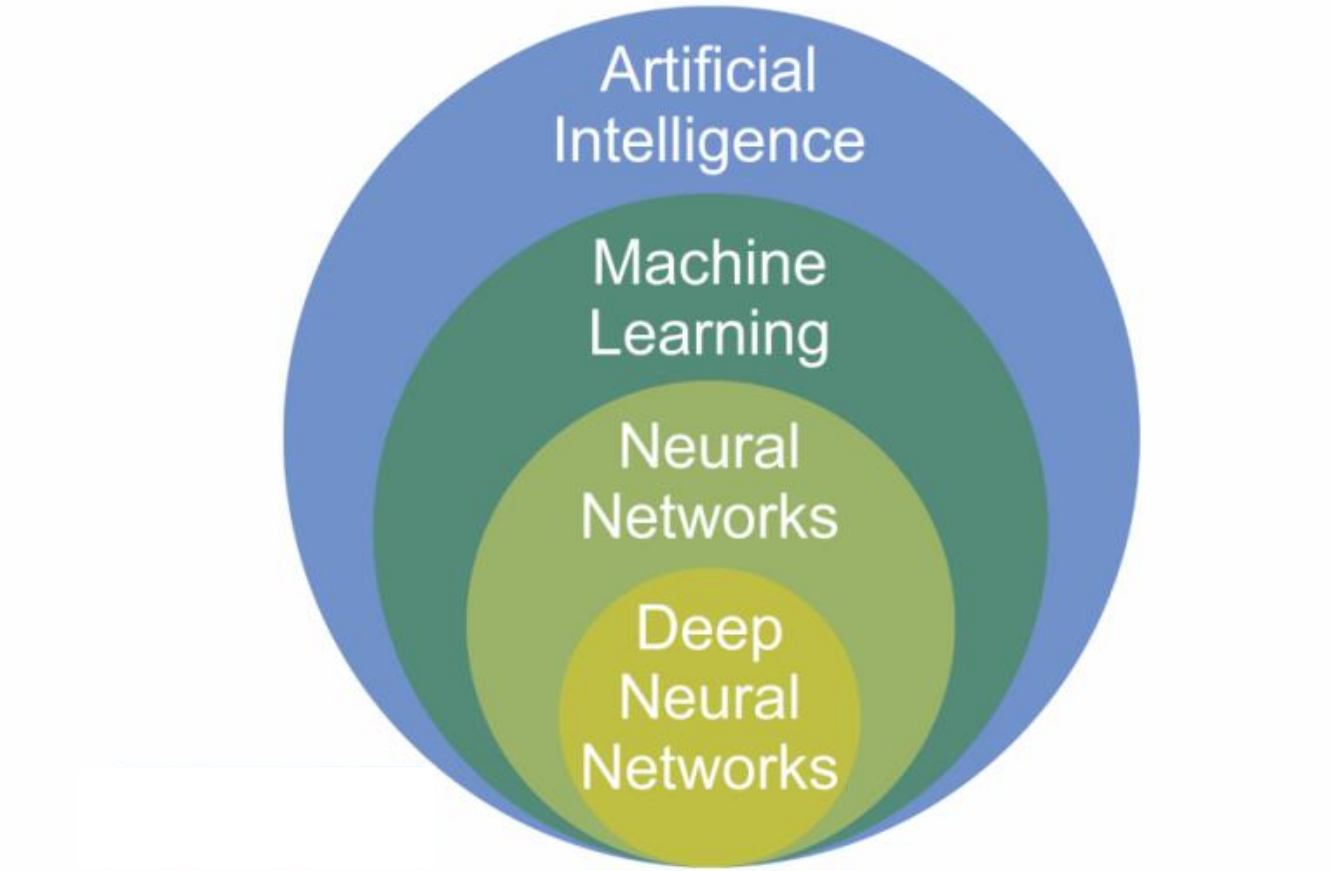

Fig: Neural Network as a subfield of Artificial Intelligence

Source: Google Images

Introduction

Brief Evolution of Neural Networks:

- Neural Network was introduced in the 1940s.
- How to train it remained a mystery for 20 years.
- The concept of backpropagation came in the 1960s.
- Neural Networks got attention somewhere around 2010.
- Neural Networks have used for image captioning, language translation, audio and video synthesis, and more.
- In addition, more challenging problems like self-driving cars, calculating risk, detecting fraud, and early cancer detections etc. became feasible.

Introduction

Biological Neuron

The most basic information-processing unit in the human brain.

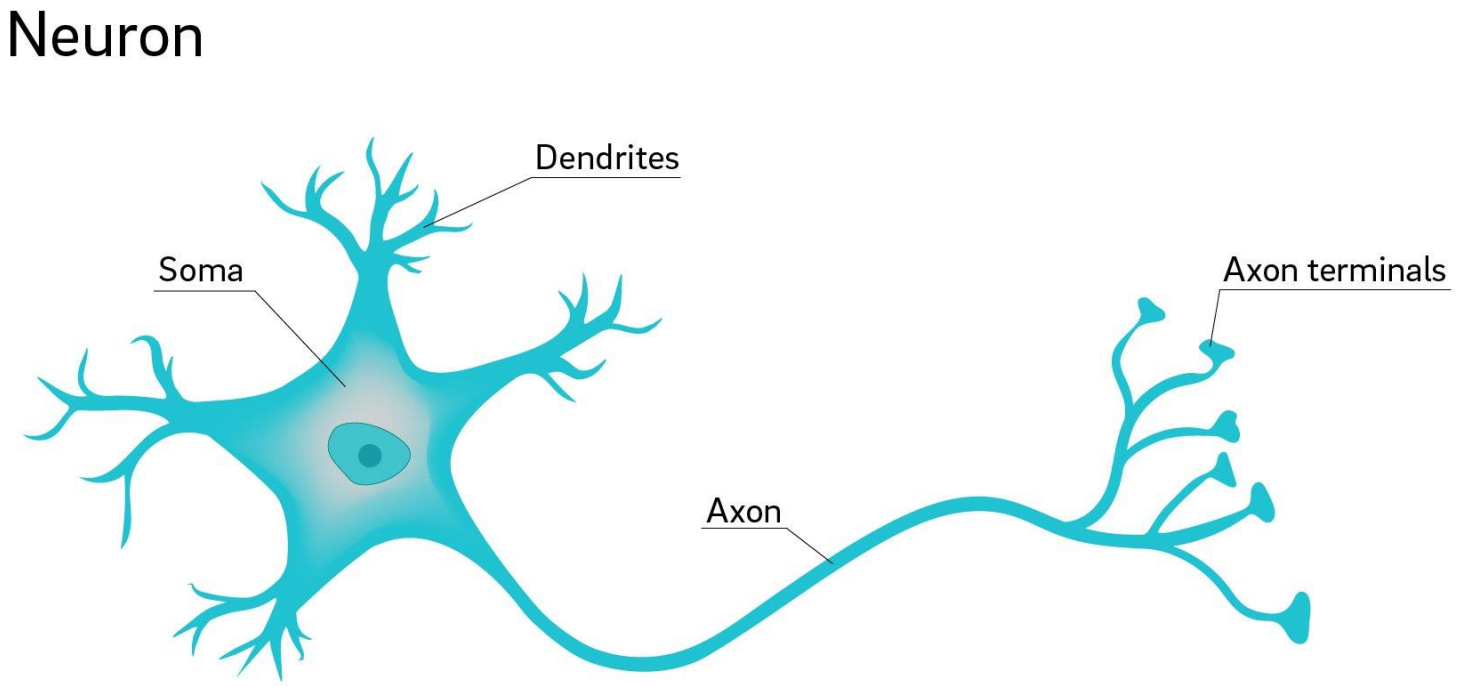

Fig: A biological neuron.

Source: Neural Networks,'' by Simon Haykin

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What is Artificial Neuron?

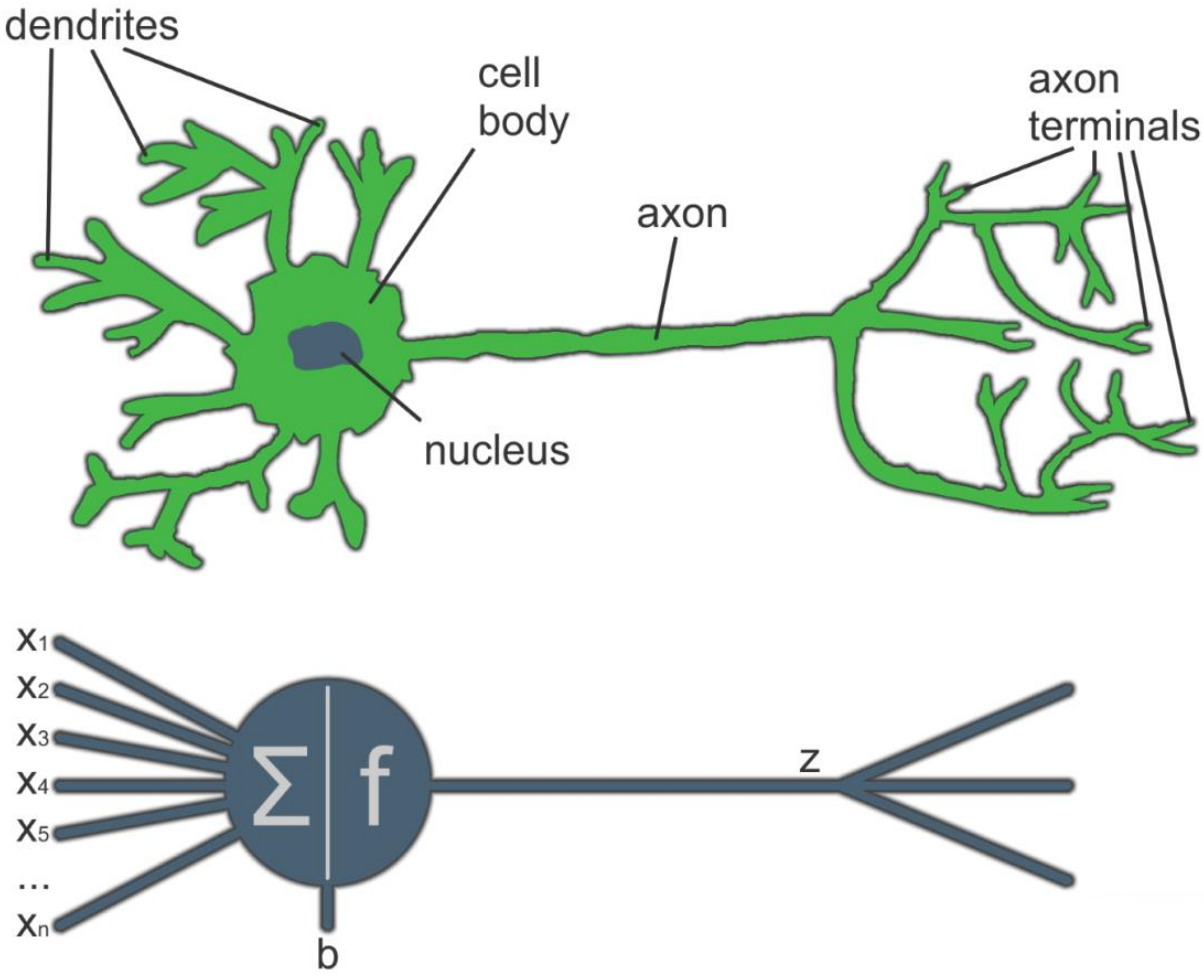

Fig: Comparing a biological neuron to an artificial neuron.

Source: Google Images

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Neural Network

A Neural Network is a parallel distributed system made up of simple processing units, known as neurons, which has a natural tendency of storing experiential knowledge and making it available for use.

It resembles the brain in two respects:

1. Knowledge is acquired through the learning process.
2. Inter-neuron connection weights, are used to store the acquired knowledge.

Source: Neural Networks,'' by Simon Haykin

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Example Neural Networks

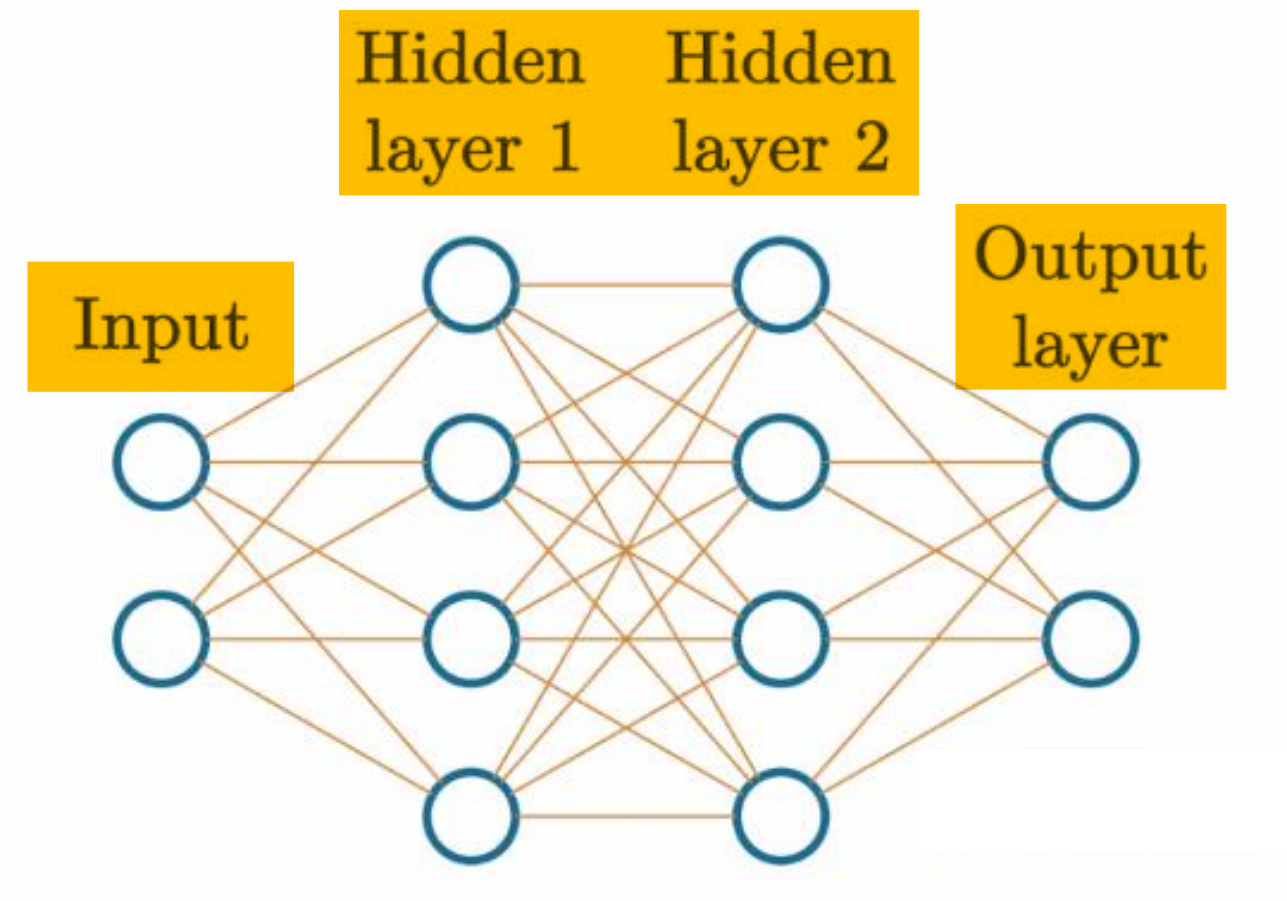

Fig : Example basic neural network.

Source: Google Images

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Example Neural Networks

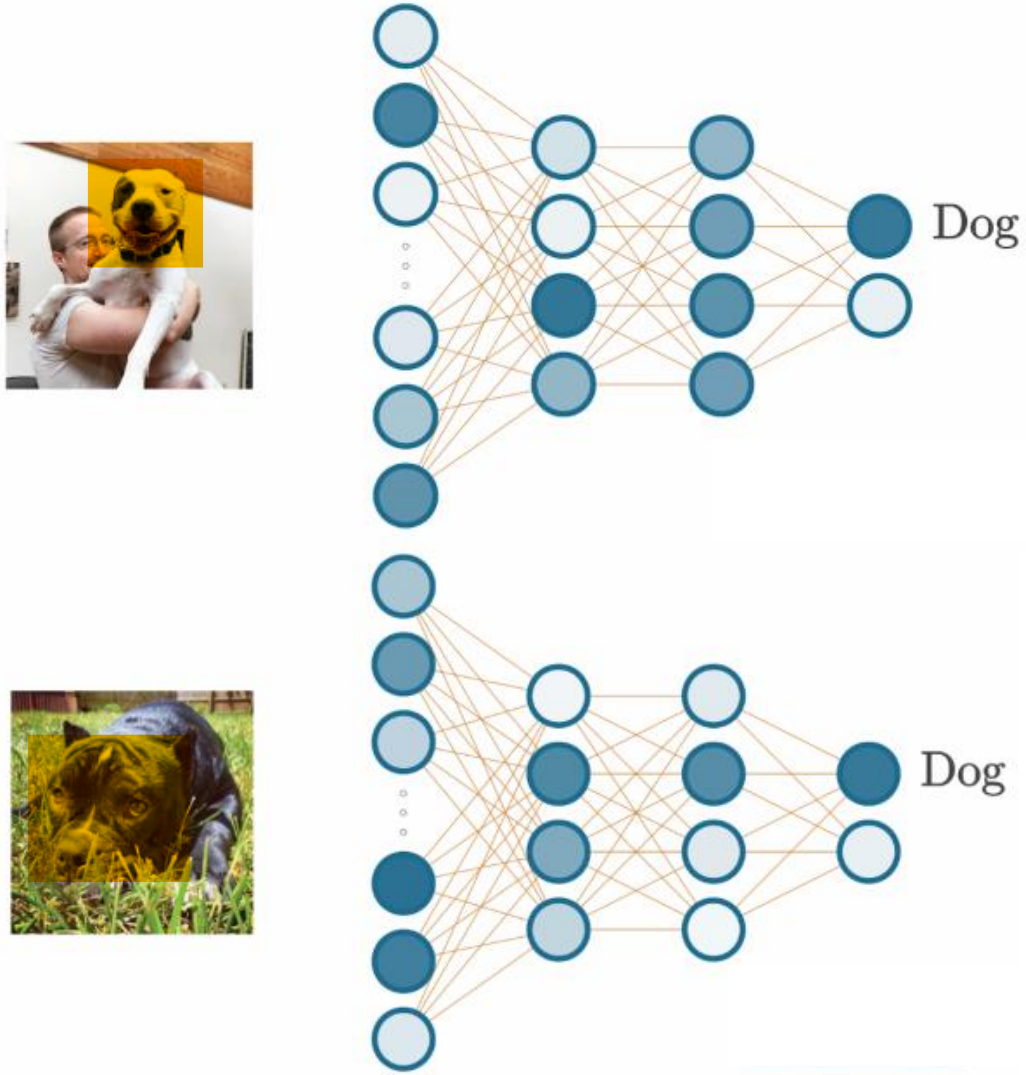
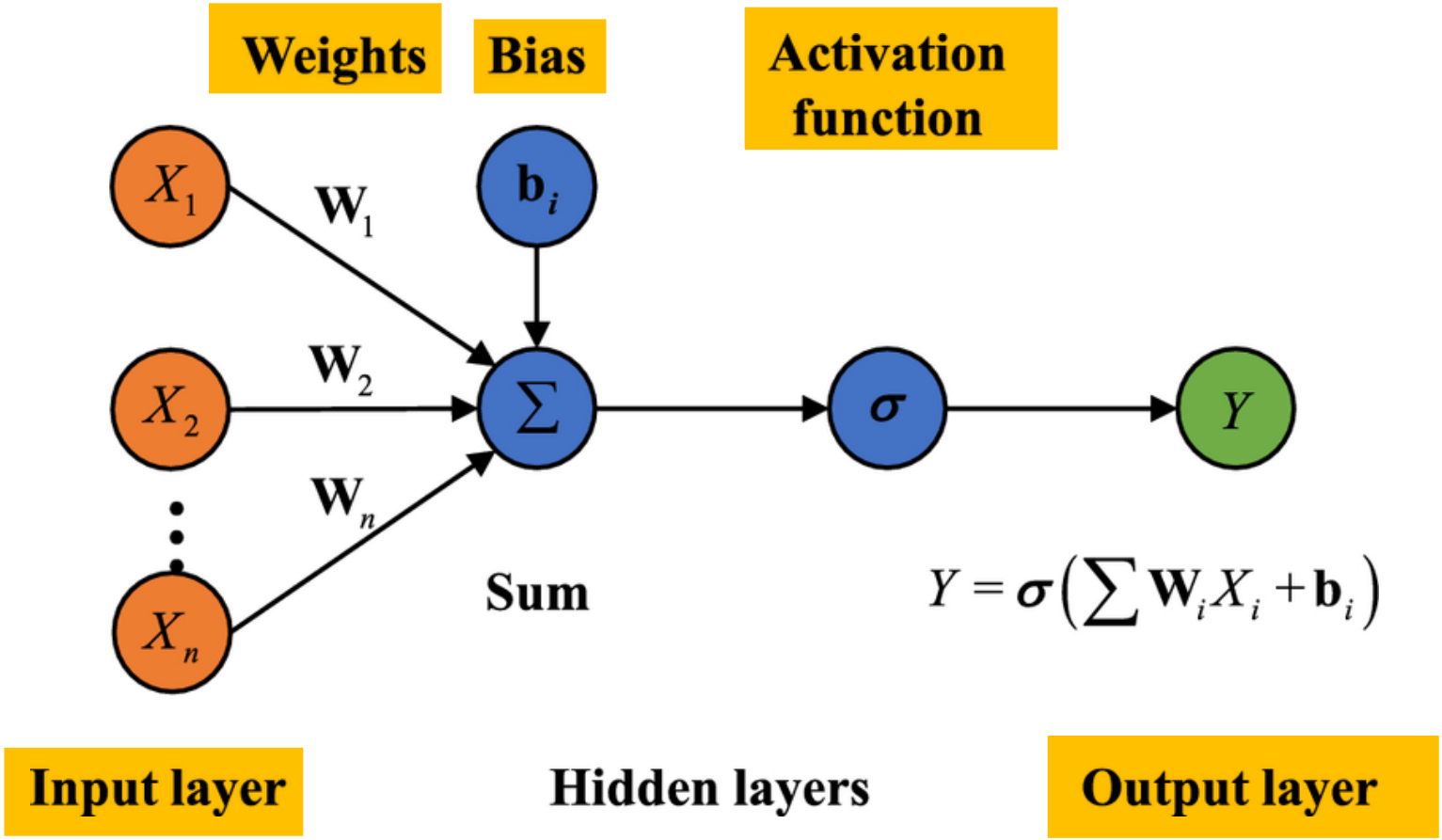


Fig : Visual depiction of passing image data through a neural network, getting a classification

Source: Google Images

Artificial Neuron Model

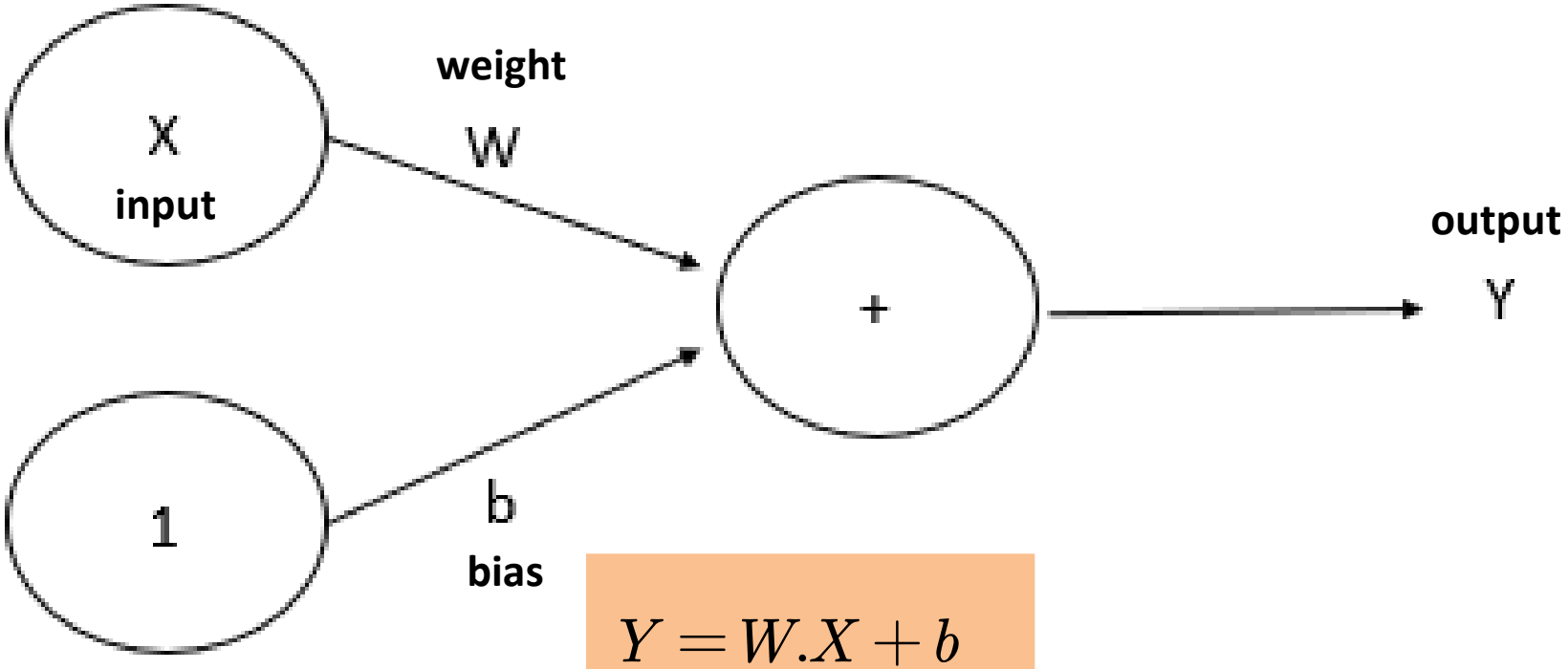
Model of an artificial neuron



Source: Google Images

Artificial Neuron Model

Simplest model of an artificial neuron



$$Y = W.X + b$$

$$y = m.x + c$$

Source: GI