SNS COLLEGE OF ENGINEERING

Kurumbapalayam(Po), Coimbatore – 641 107
Accredited by NAAC-UGC with 'A' Grade
Approved by AICTE, Recognized by UGC & Affiliated to Anna University, Chennai

Department of AI &DS

Course Name – 19AD602 DEEP LEARNING

III Year / VI Semester

Unit 1-INTRODUCTION
Topic: INTRODUCTION TO DEEP LEARNING

Case study:

Identifying Handwritten Digits with Deep Learning

Context

The MNIST dataset consists of handwritten digits (0–9), widely used for training image processing systems. The challenge is to classify images of these digits using a deep learning approach.

Objective

Build a neural network model to classify handwritten digits.

Approach

1. **Data Collection:** Use the MNIST dataset, which contains 60,000 training and 10,000 testing grayscale images. Each image is 28x28 pixels.
2. **Model Architecture:** A simple neural network with one input layer, one hidden layer with 128 neurons (ReLU activation), and an output layer with 10 neurons (softmax activation for classification).
3. **Training:** Train the model using cross-entropy loss and the Adam optimizer.
4. **Evaluation:** Check the accuracy on the test set and visualize misclassified images.

Outcome

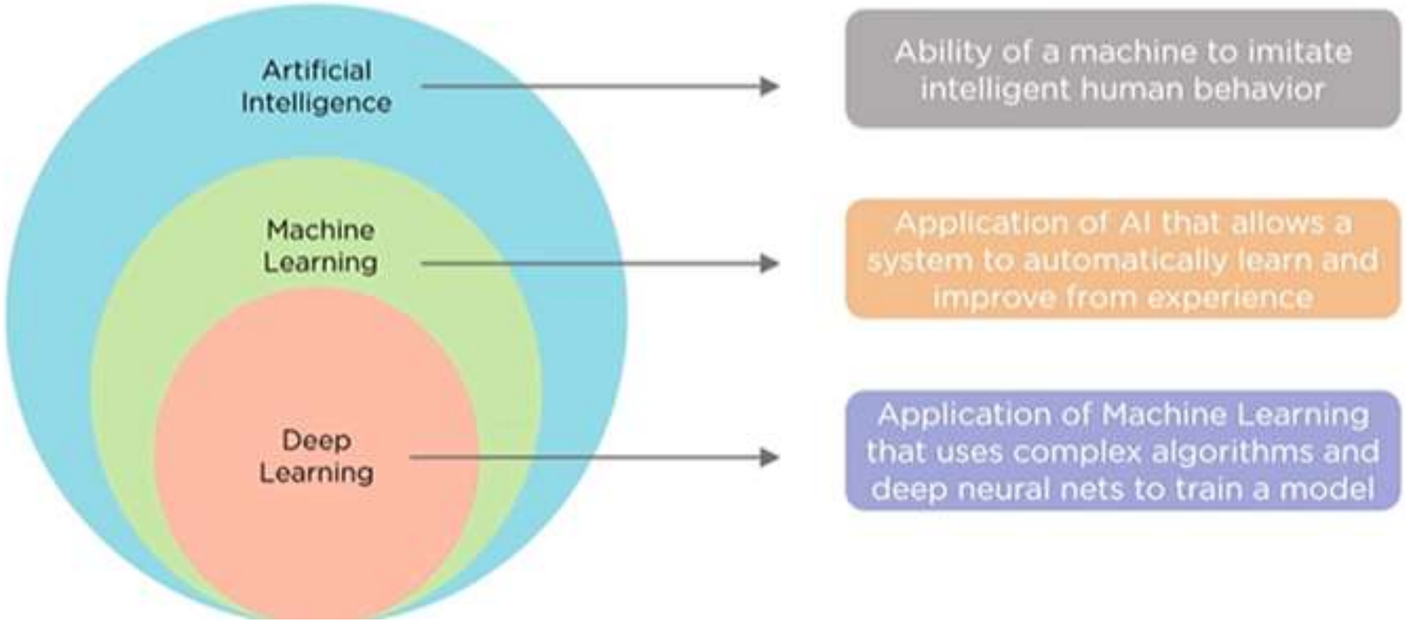
The model achieves approximately 97% accuracy on the test set, demonstrating the effectiveness of neural networks in recognizing handwritten digits.

INTRODUCTION TO DEEP LEARNING

INTRODUCTION TO DEEP LEARNING

What is Deep Learning?

Deep Learning is a subfield of Machine Learning that deals with algorithms inspired by the structure and function of the brain



Why do we need Deep Learning?

Process huge amount of data

Machine Learning algorithms work with huge amount of structured data but Deep Learning algorithms can work with enormous amount of structured and unstructured data

Perform complex algorithms

Machine Learning algorithms cannot perform complex operations, to do that we need Deep Learning algorithms

To achieve the best performance with large amount of data

As the amount of data increases, the performance of Machine Learning algorithms decreases, to make sure the performance of a model is good, we need Deep Learning

Feature Extraction

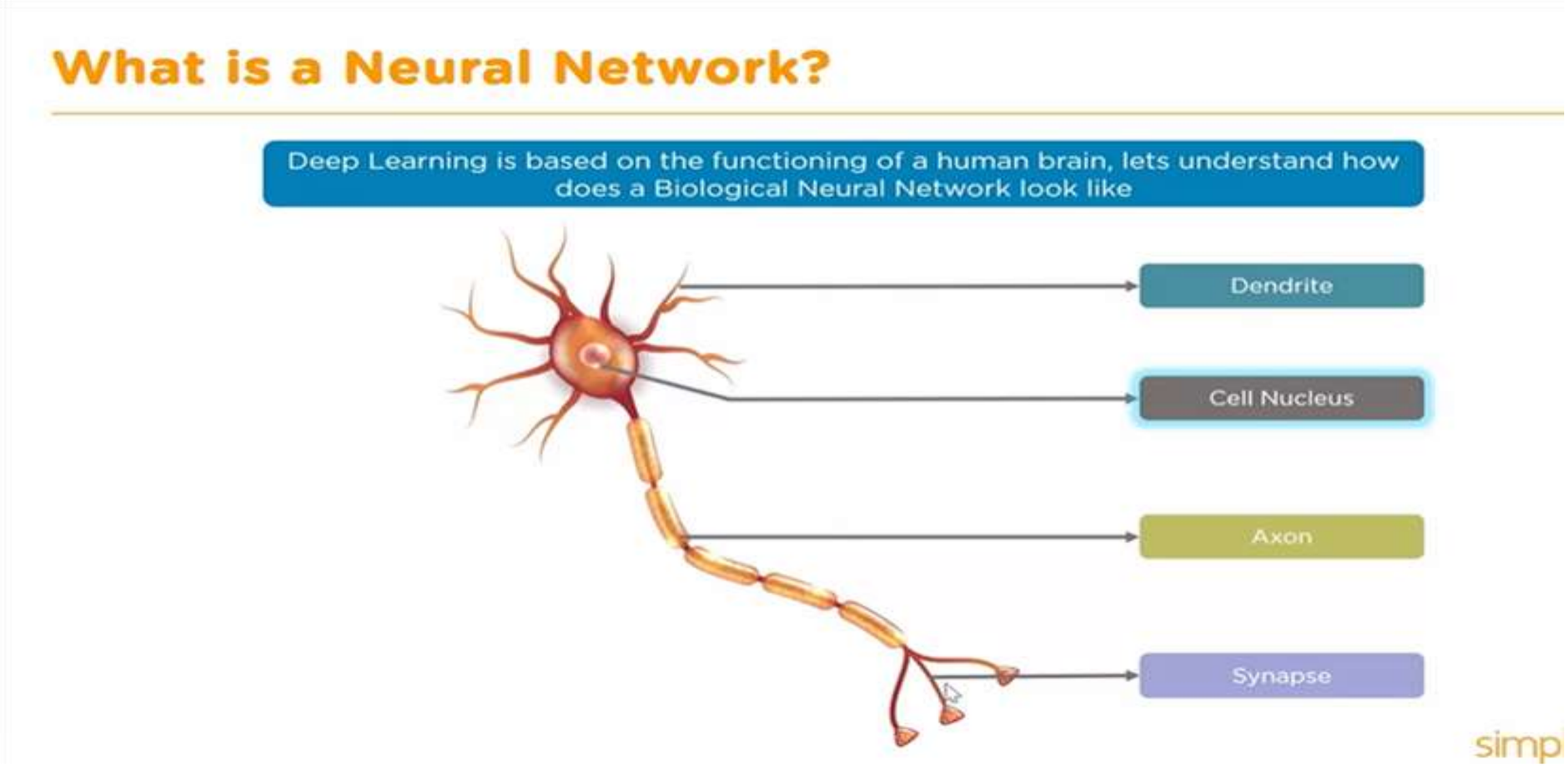
Machine Learning algorithms extract patterns based on labelled sample data, while Deep Learning algorithms take large volumes of data as input, analyze the input to extract features out of an object and identifies similar objects

INTRODUCTION TO DEEP LEARNING

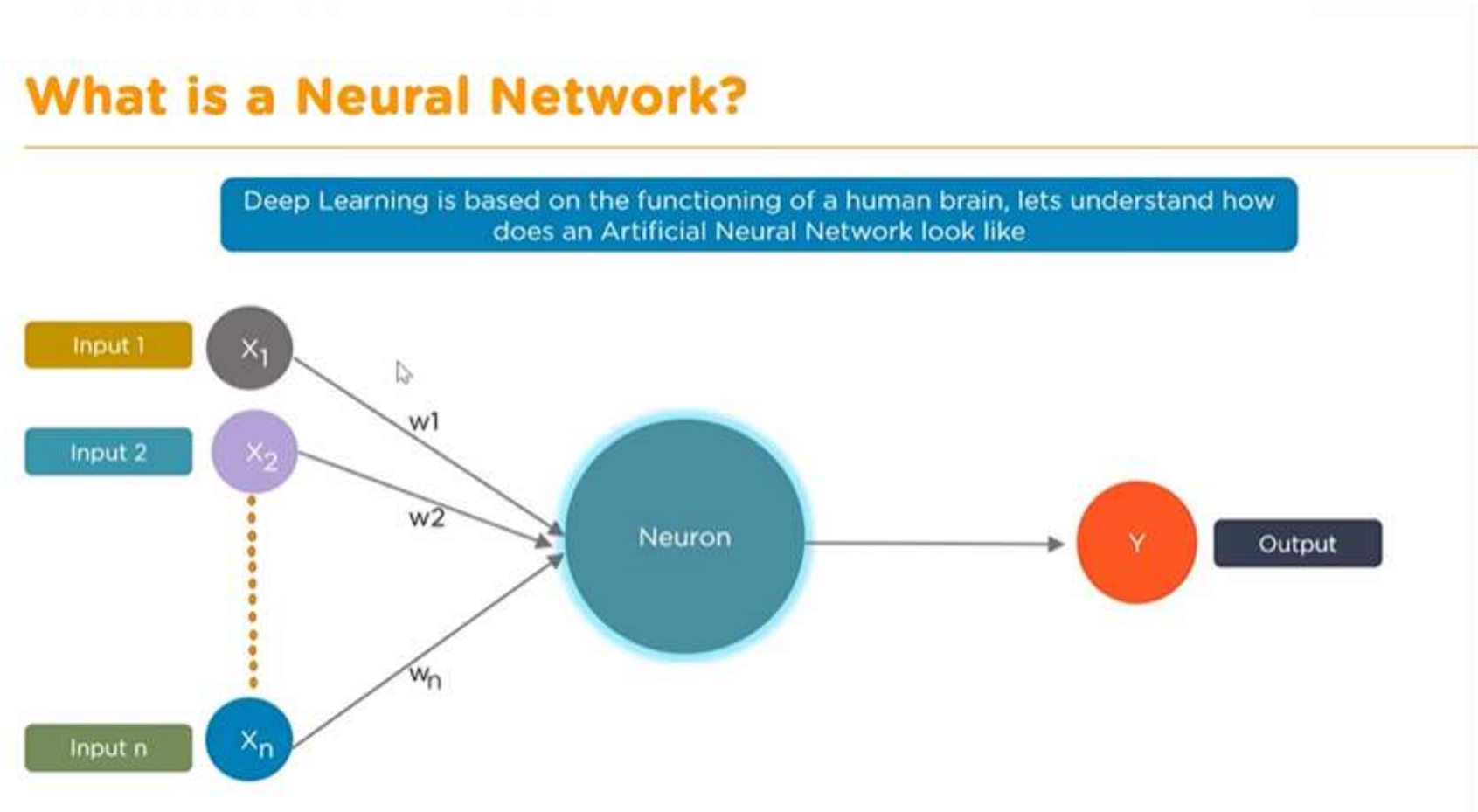
APPLICATIONS OF DEEP LEARNING:

1. **Fraud detection**
2. **Customer service**
3. **Financial services**
4. **Natural language processing**
5. **Facial recognition**
6. **Self-driving vehicles**
7. **Predictive analytics**
8. **Recommender systems**
9. **Industrial…etc..,**

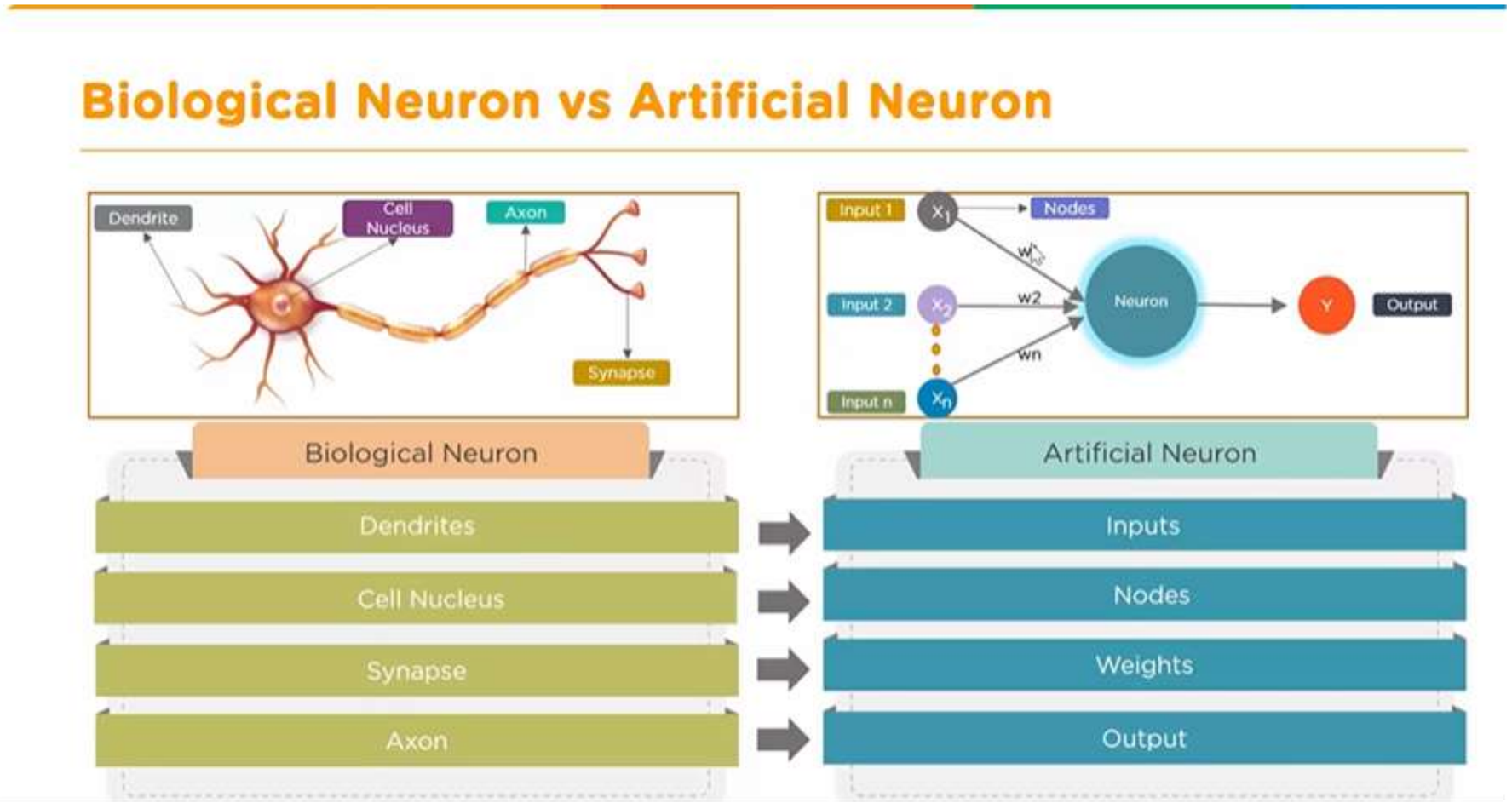
INTRODUCTION TO DEEP LEARNING



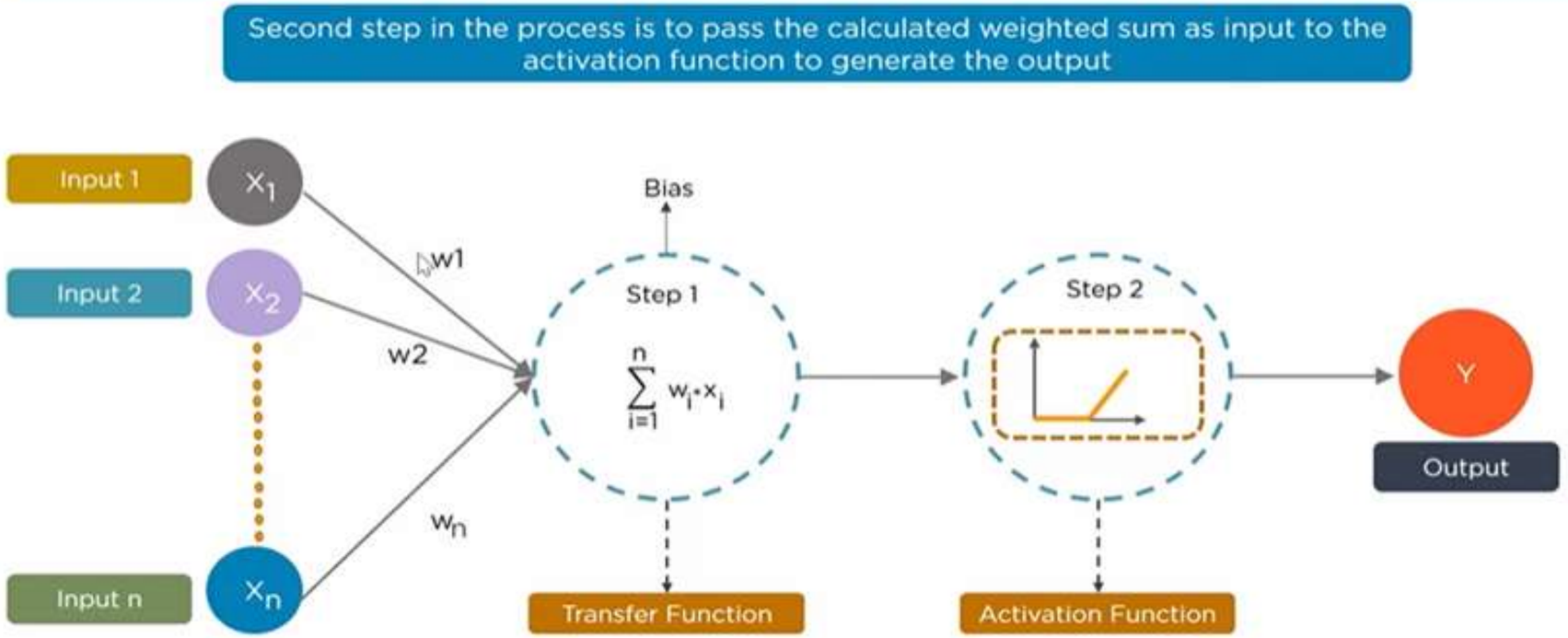
INTRODUCTION TO DEEP LEARNING



INTRODUCTION TO DEEP LEARNING

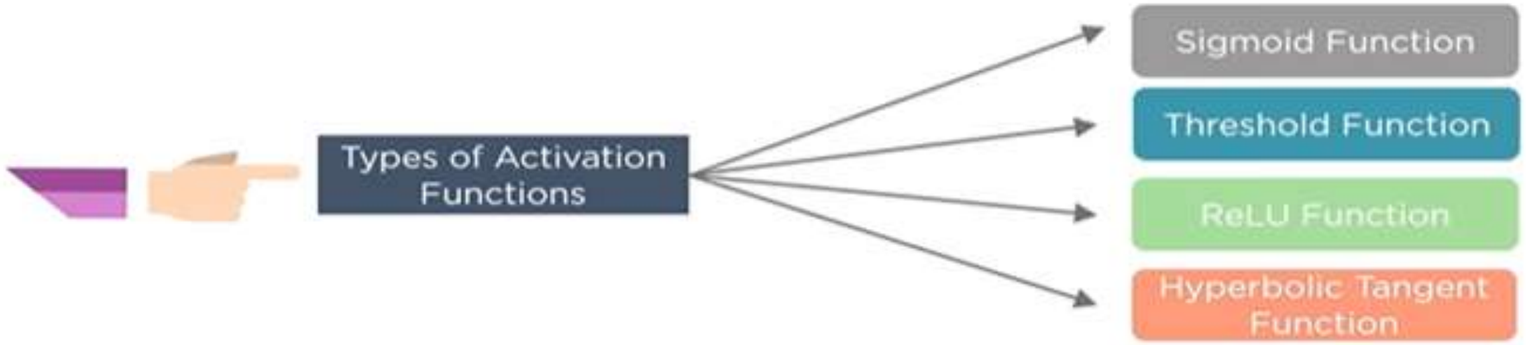


What is a Neural Network?



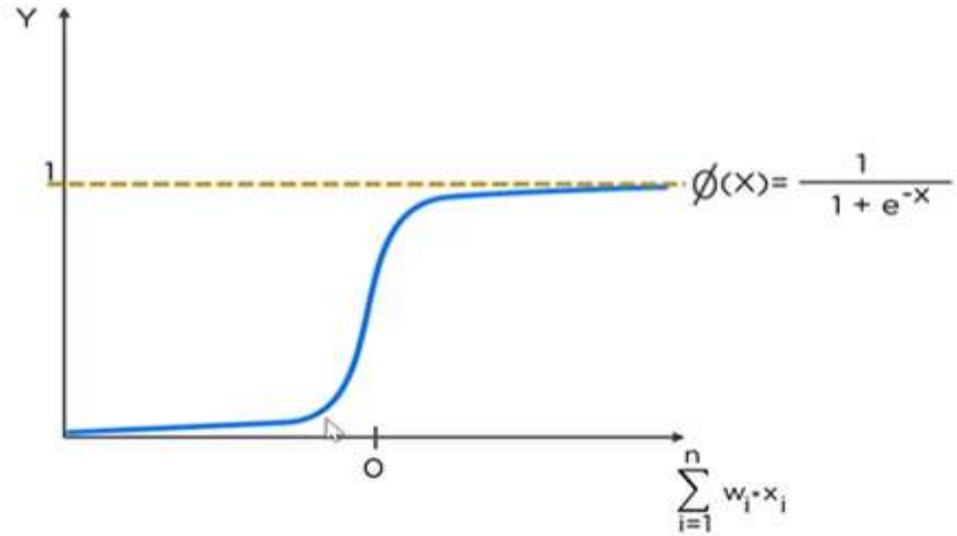
Activation Functions

An Activation function takes the "weighted sum of input plus the bias" as the input to the function and decides whether it should be fired or not



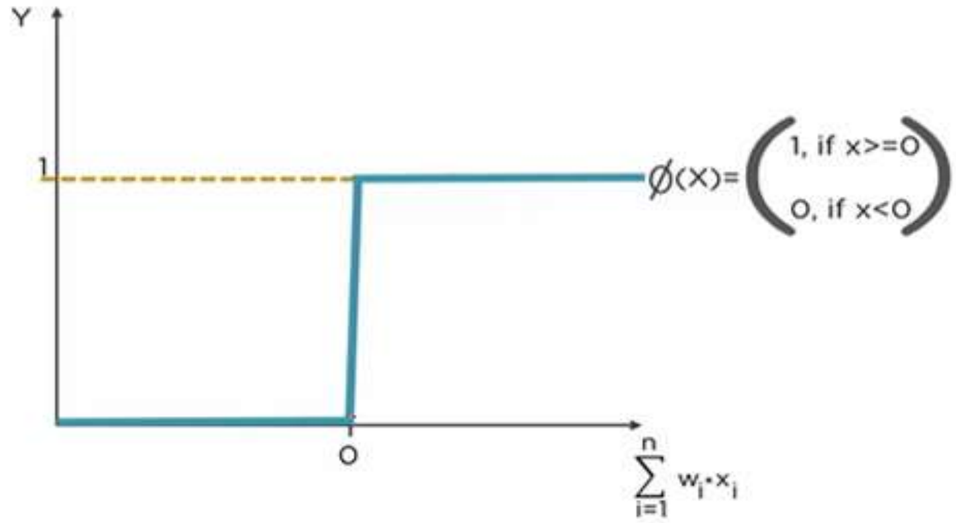
Activation Functions

Sigmoid Function → Used for models where we have to predict the probability as an output. It exists between 0 and 1.



Activation Functions

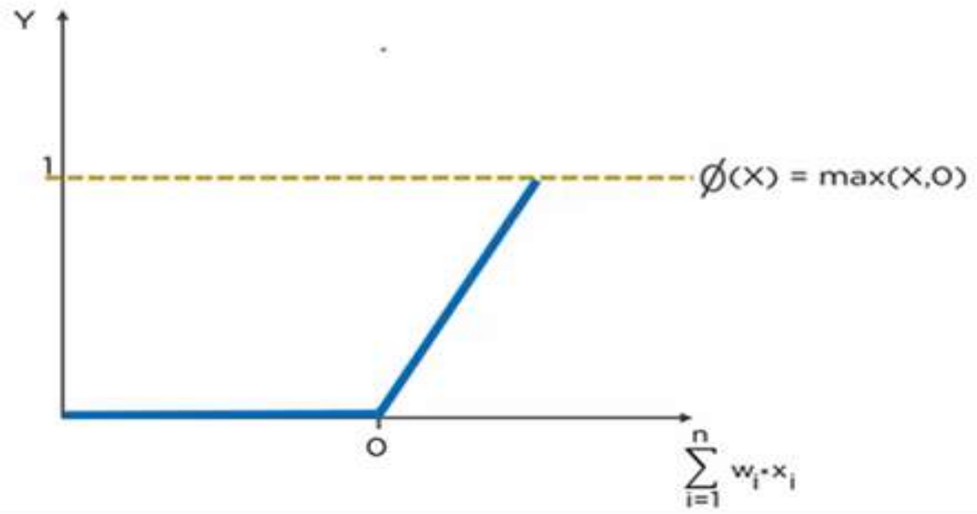
Threshold Function → It is a threshold based activation function. If Y value is greater than a certain value, the function is activated and fired else not.



simplilearn

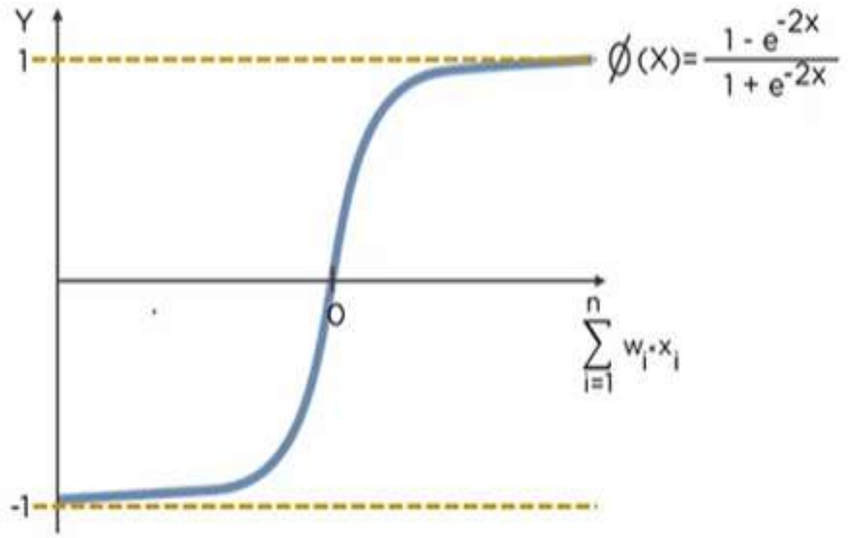
Activation Functions

ReLU Function → It is the most widely used Activation function and gives an output of X if X is positive and 0 otherwise

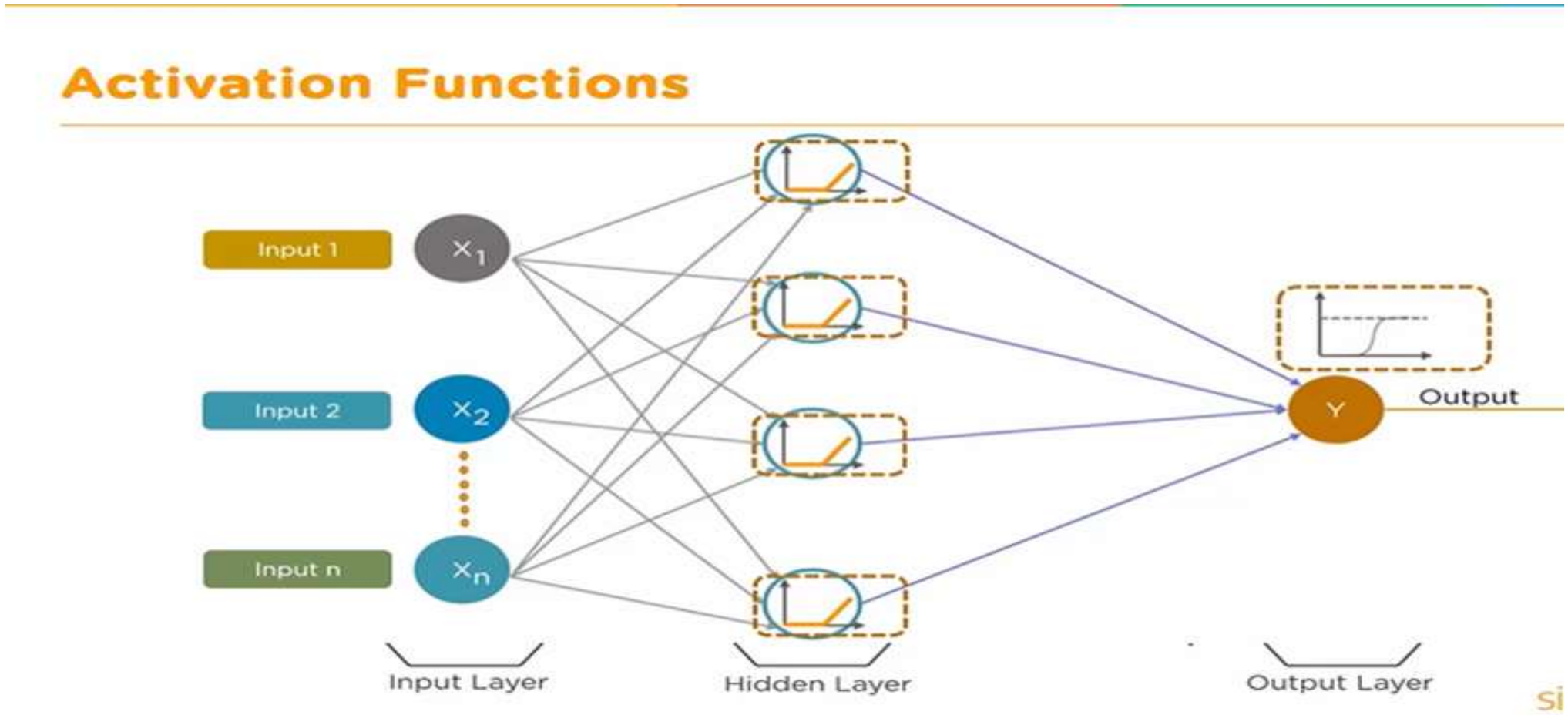


Activation Functions

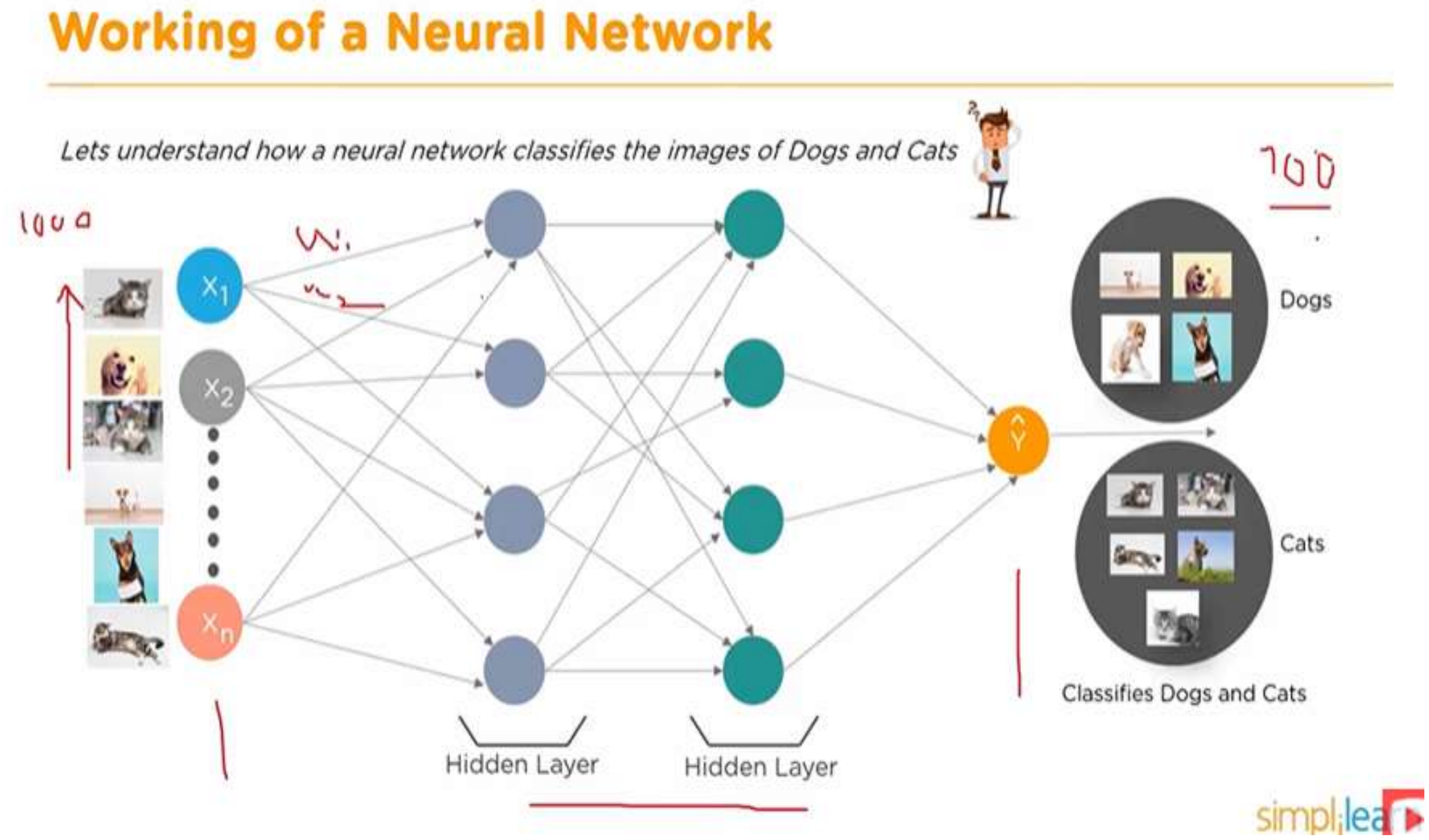
Hyperbolic Tangent Function → This function is similar to Sigmoid function and is bound to range (-1, 1)



INTRODUCTION TO DEEP LEARNING

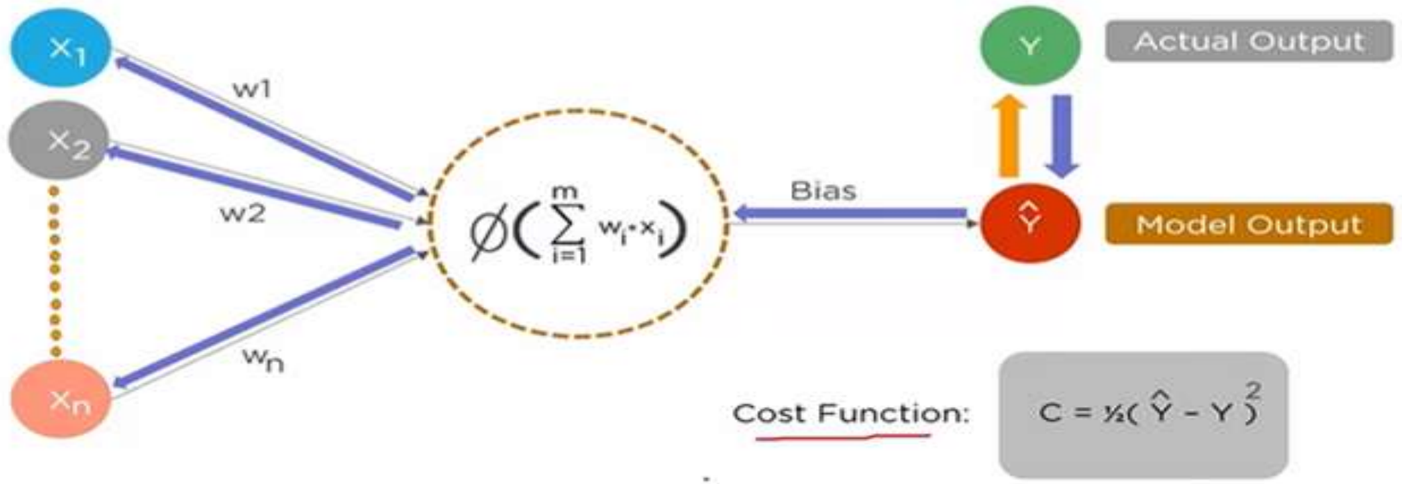


INTRODUCTION TO DEEP LEARNING



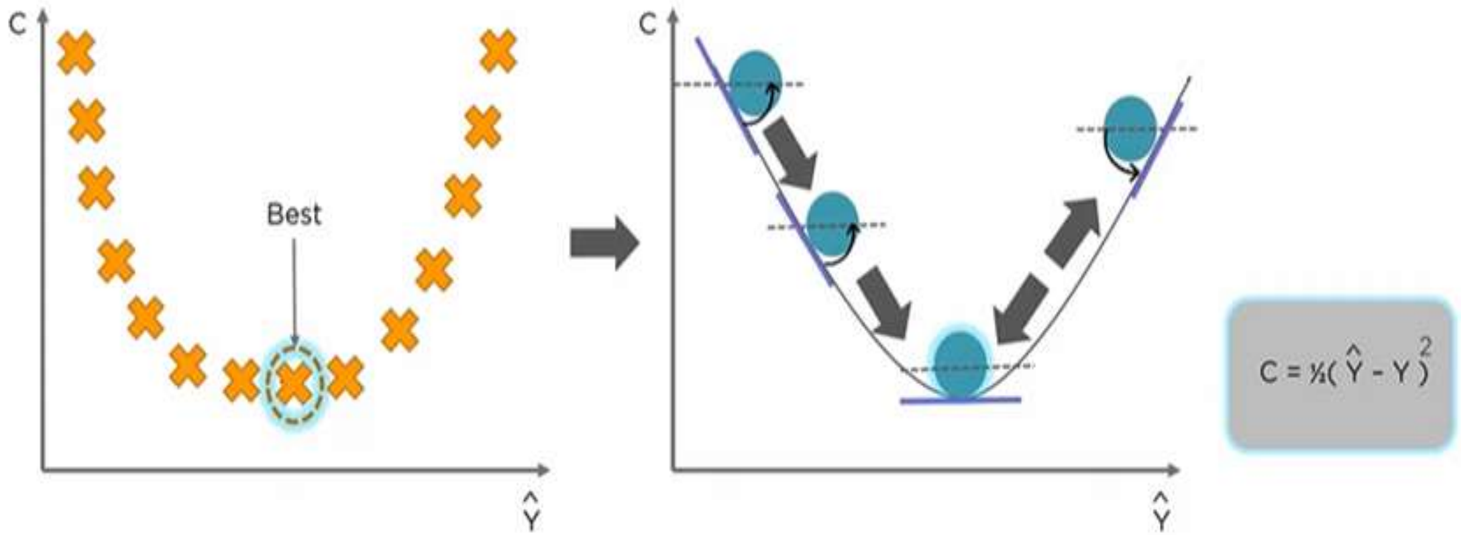
Working of a Neural Network

After training the Neural Network, it uses *Backpropagation* method to improve the performance of the network. Cost Function helps to reduce the error rate.

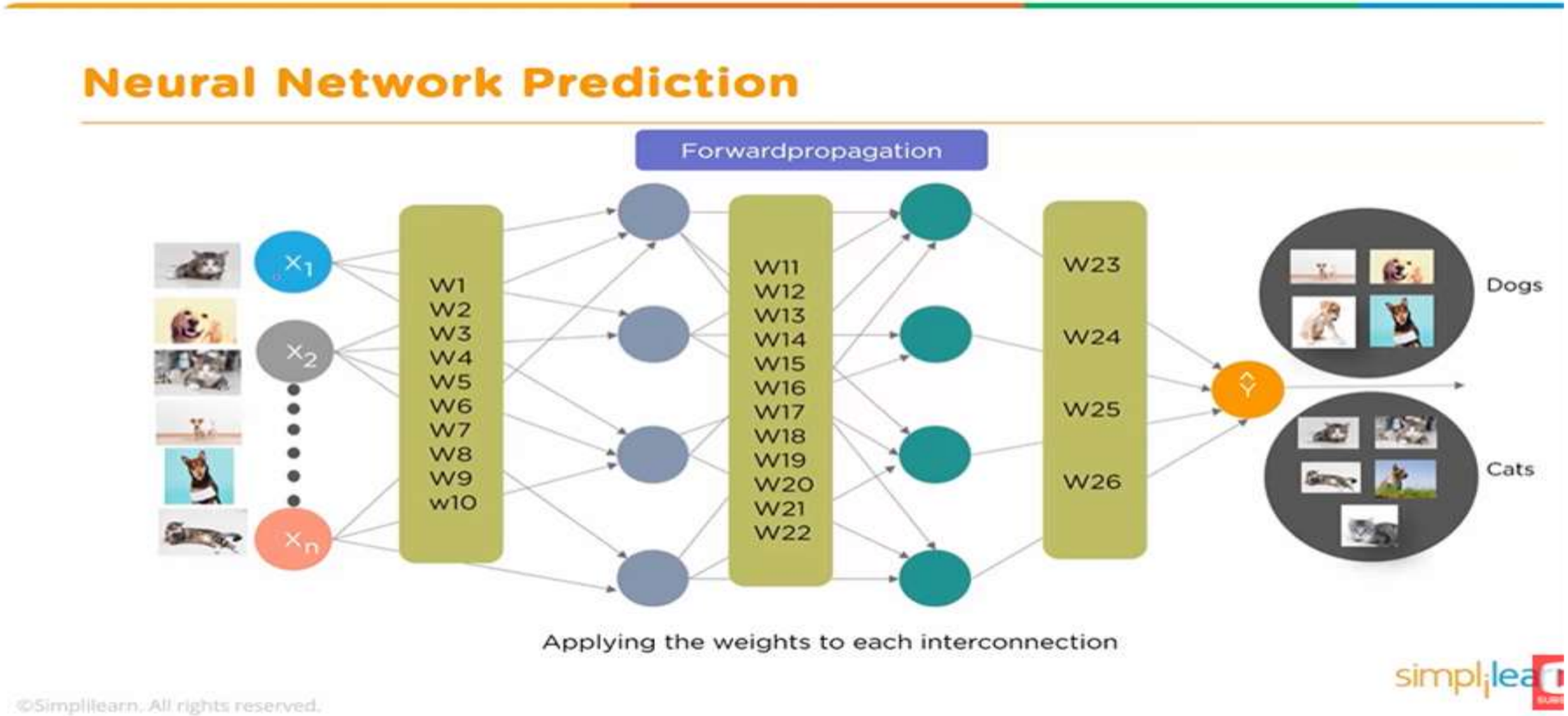


Gradient Descent

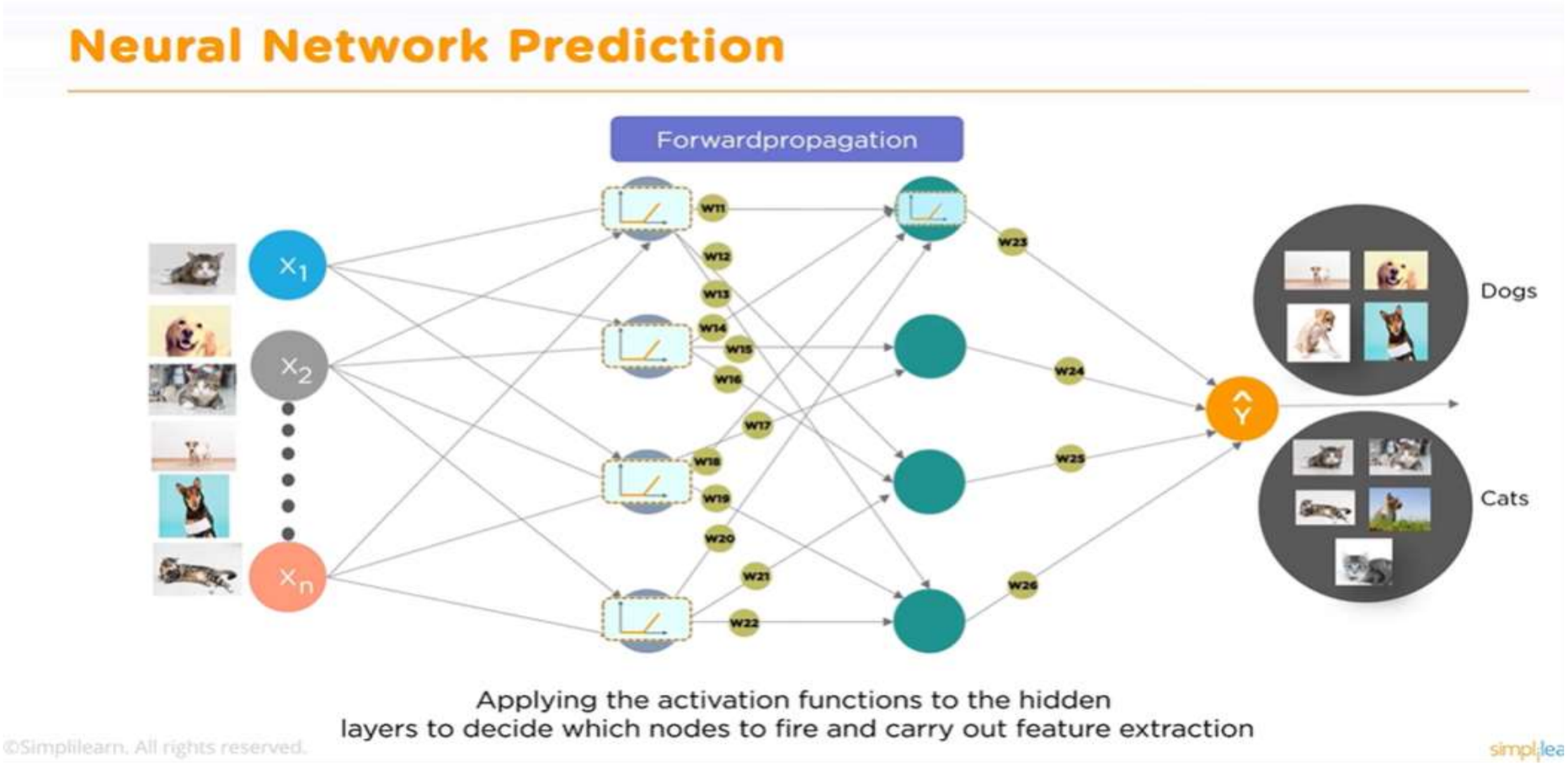
Gradient Descent is an optimization algorithm for finding the minimum of a function



INTRODUCTION TO DEEP LEARNING



INTRODUCTION TO DEEP LEARNING



Activity: **Build Your Own Neural Network**

Objective: Learn how a neural network operates by building one yourself.

Setup:

- Divide participants into small groups.
- Provide each group with a set of cards representing nodes and weights. Use colored markers to indicate inputs, hidden layers, and outputs.

Steps:

1. **Define the Input:** Assign groups a task, e.g., classify whether a given "animal image" is a cat or dog (use analogies for simplicity).
2. **Build Layers:** Ask groups to connect "input cards" (features) to "hidden nodes" and finally to "output cards" (class labels).
3. **Forward Pass:** Groups calculate the outputs at each layer, mimicking matrix operations.
4. **Activation Function:** Introduce rules like "output > 0 means activate the node" (ReLU) and apply these rules.
5. **Output Result:** Summarize outputs for classification.

THANK YOU