MICROSPECTRA SOFTWARE TECHNOLOGIES PVT. LTD.

INTRODUCTION TO

DATA SCIENCE ARTIFICIAL INTELLIGENCE

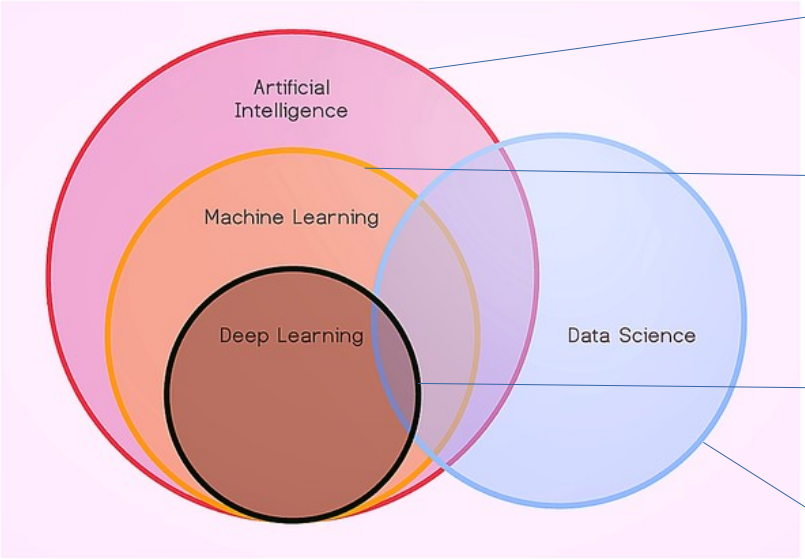
MACHINE LEARNING DEEP LEARNING

Topic:- Deep Learning(lect no:-7)

Certification & Internship Program

INTRODUCTION TO DEEP LEARNING

What Is Deep Learning?



ARTIFICIAL INTELLIGENCE

A technique which enables machine to mimic human behaviour.

MACHINE LEARNING

Subset of AI technique which use statistical method to enable machine to improve with experience.

DEEP LEARNING

Subset of ML which make the computation of multi-layer neural network feasible

DATA SCIENCE

Data science is an inter-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from many structural and unstructured data.

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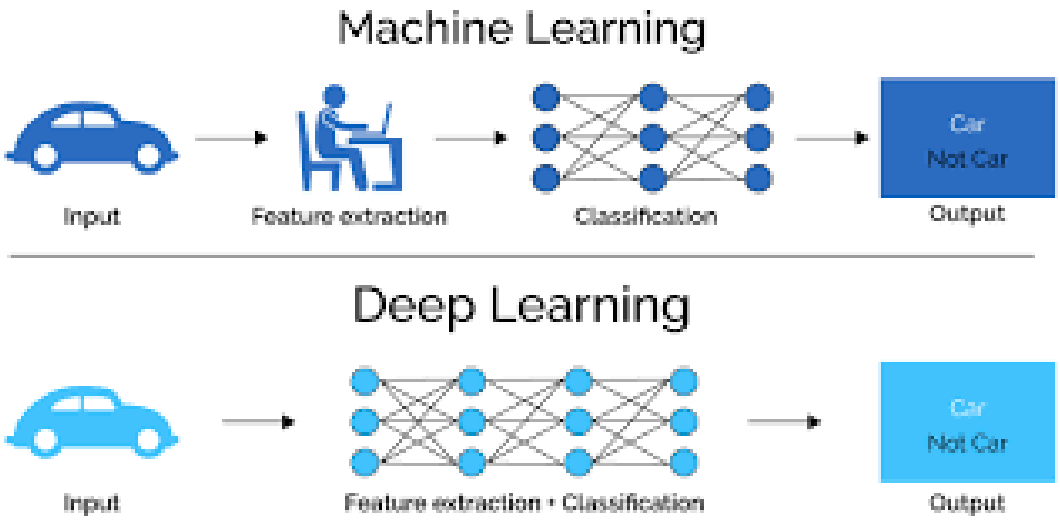
Difference Between Deep Learning & Machine Learning



MACHINE LEARNING

features have to be specified before feed to algorithms

D**EEP LEARNING**

model itself predicts for best features as per algorithms.

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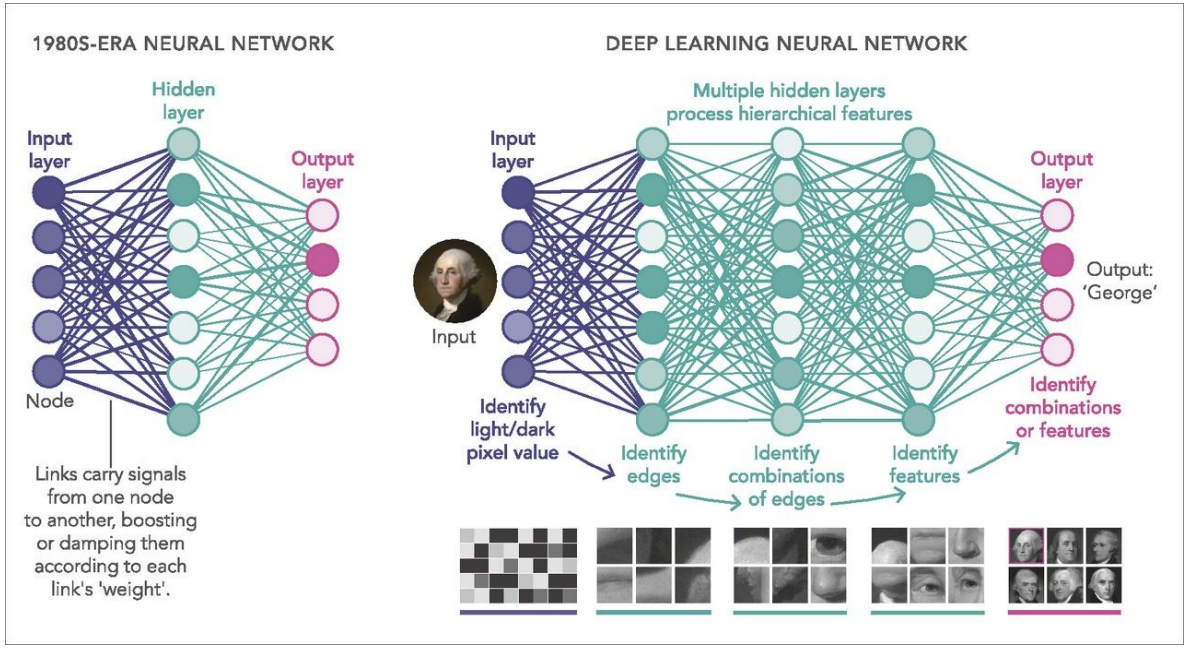
DEFINITION OF DEEP LEARNING?

Deep learning is a subset of machine learning in artificial intelligence (AI) that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Also known as deep neural learning or deep neural network.

WHERE DATA MAY BE IMAGES, TEXT OR SOUND.



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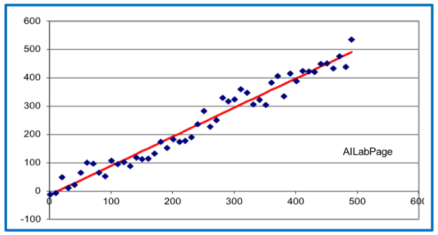
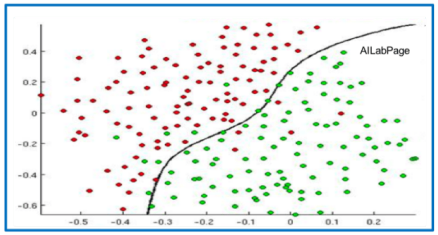
CATEGORIZATION OF DEEP LEARNING ?

01 **Supervised Learning -** Labelled data which make life easy for algorithms to learn and predict. It makes easy for algorithm to output from the input data.

02 **Unsupervised**: Used for inheriting structures and pattern detection through algorithms from the input data. Data is unlabelled here

03 **Semi-supervised**: Mixture of supervised and unsupervised techniques can be used. As some data is labelled and most of it is unlabelled.





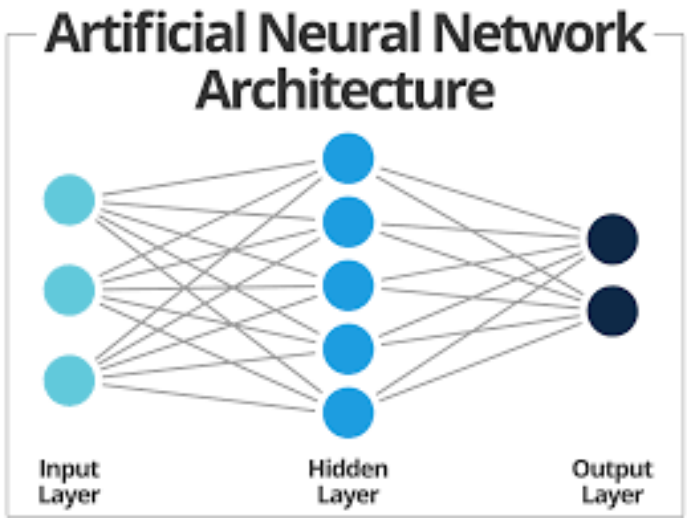
Regression

1. The system attempts to predict a value for an input based on past data.
2. Real number / Continuous numbers – Regression problem
3. Example – 1. Temperature for tomorrow

Classification

1. In classification, predictions are made by classifying them into different categories.
2. Discreate / categorical variable – Classification problem
3. Example – 1. Type of cancer 2. Cancer Y/N

AILabPage



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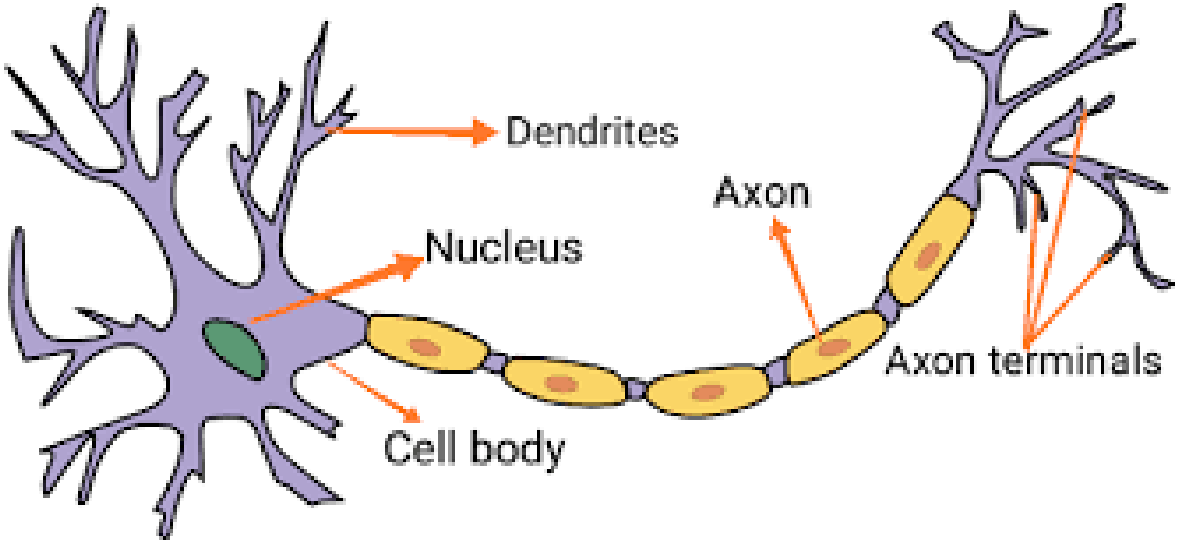
WHAT IS NEURON ?



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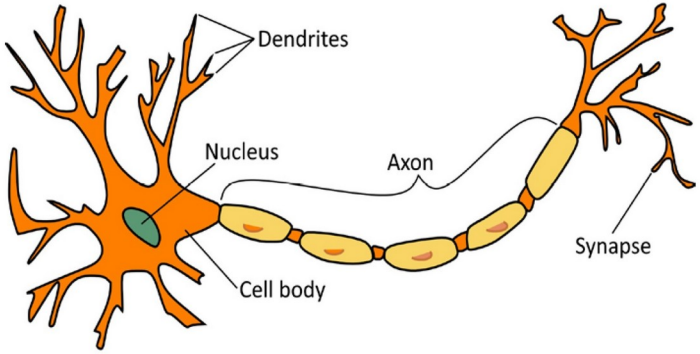
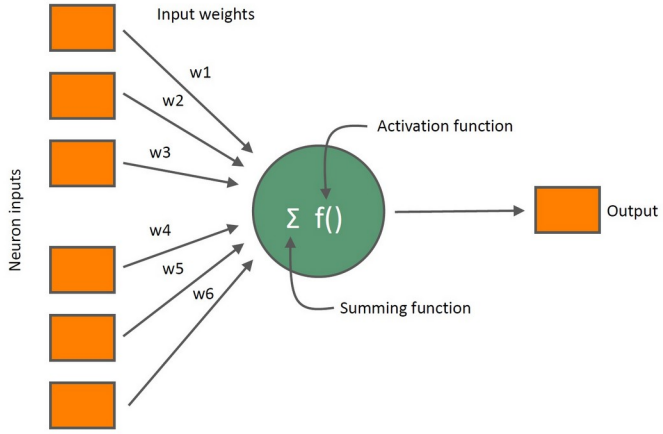
Perceptron In Deep Learning ?





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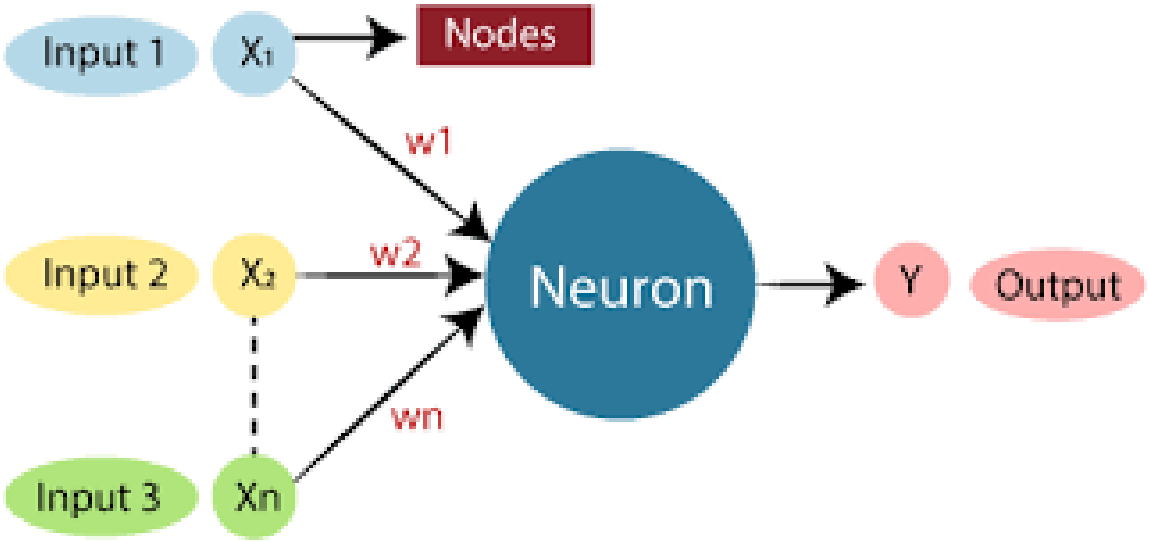

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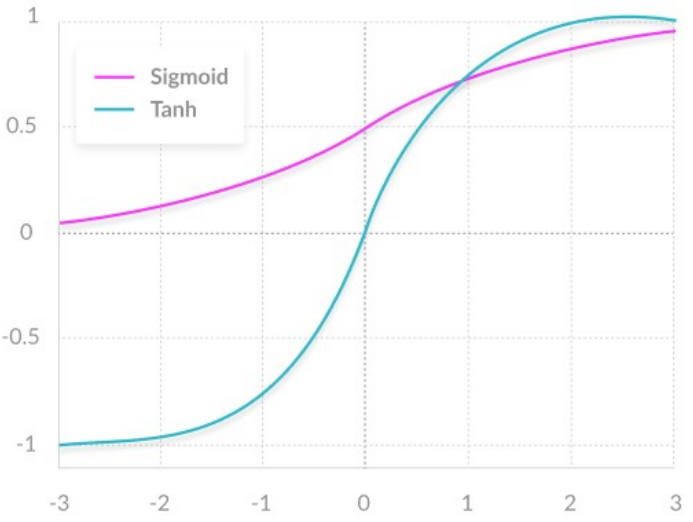
What is an Activation Function ?

Activation functions are mathematical equations that determine the output of a neural network. The function is attached to each neuron in the network, and determines whether it should be activated (“fired”) or not, based on whether each neuron’s input is relevant for the model’s prediction. Activation functions also help normalize the output of each neuron to a range between 1 and 0 or between -1 and 1.

Y = Activation(sum(weights*input)+ bias)

- they must be **computationally efficient** because they are calculated across thousands or even millions of neurons for each data sample.

- **Non Linear Transformation.**
- **Linear Activation Function.**
- **Non Linear Activation Function.**



Two common neural network activation functions - Sigmoid and Tanh

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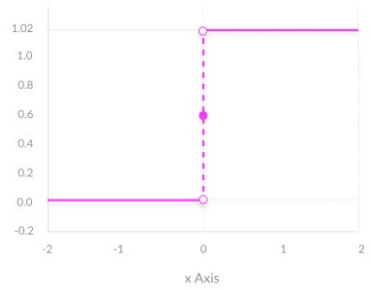
Type of Activation Function ?

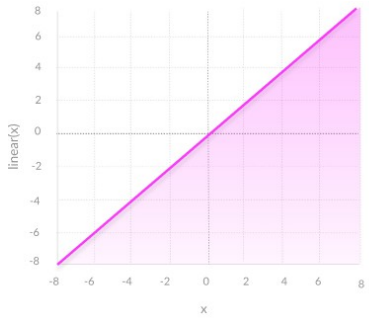
Binary Step Function

A binary step function is a threshold-based activation function. If the input value is above or below a certain threshold, the neuron is activated and sends exactly the same signal to the next layer.



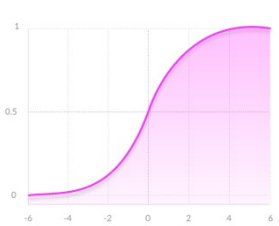
Linear Activation Function

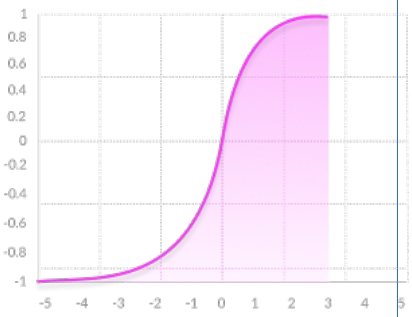
It takes the inputs, multiplied by the weights for each neuron, and creates an output signal proportional to the input. In one sense, a linear function is better than a step function because it allows multiple outputs, not just yes and no.



Non-Linear Activation Functions

Modern neural network models use non-linear activation functions. They allow the model to create complex mappings between the network's inputs and outputs, which are essential for learning and modeling complex data, such as images, video, audio, and data sets which are non-linear or have high dimensionality.





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Activation Function Example

Logistic Regression

$z = b + a_1x_1 + a_2x_2 + a_3x_3$
$p = 1.0 / (1.0 + e^{-z})$

Ex:

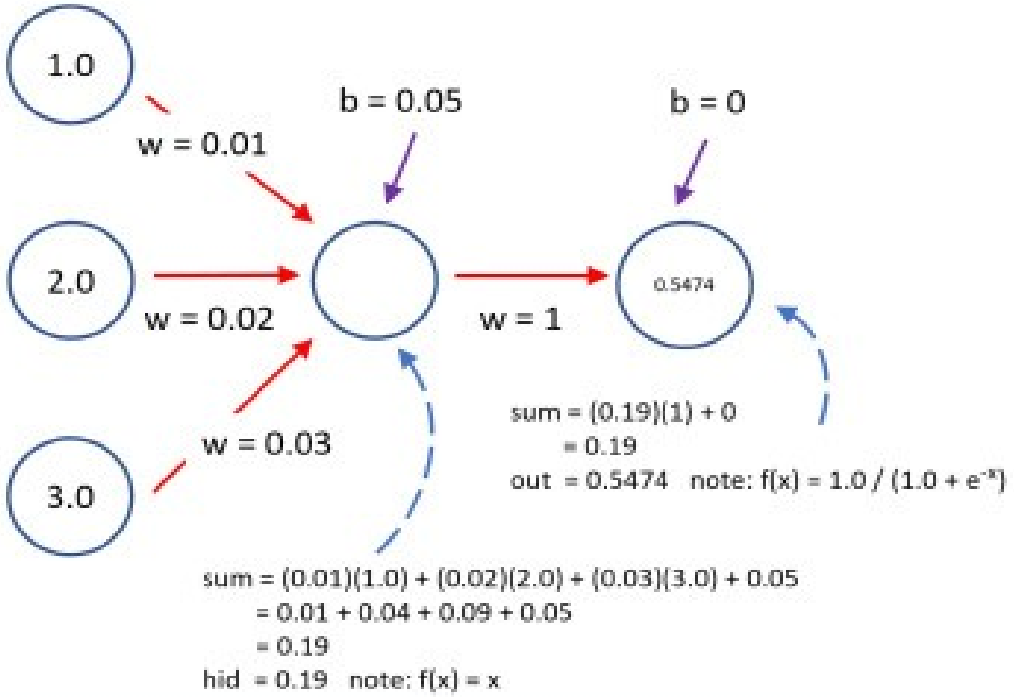
$w_1 = 1.0 \quad a_1 = 0.01$
$w_2 = 2.0 \quad a_2 = 0.02$
$w_3 = 3.0 \quad a_3 = 0.03$
$b = 0.05$

$z = (0.05) + (0.01)(1.0) + (0.02)(2.0) + (0.03)(3.0)$
$= 0.05 + 0.01 + 0.04 + 0.09$
$= 0.19$

$p = 1.0 / (1.0 + e^{-0.19})$
$= 0.5474$ (predicted class = 1)

Neural Network

single hidden layer, identity activation f(x) = x
single output node, logistic sigmoid activation f(x) = 1 / (1 + e^{-x})



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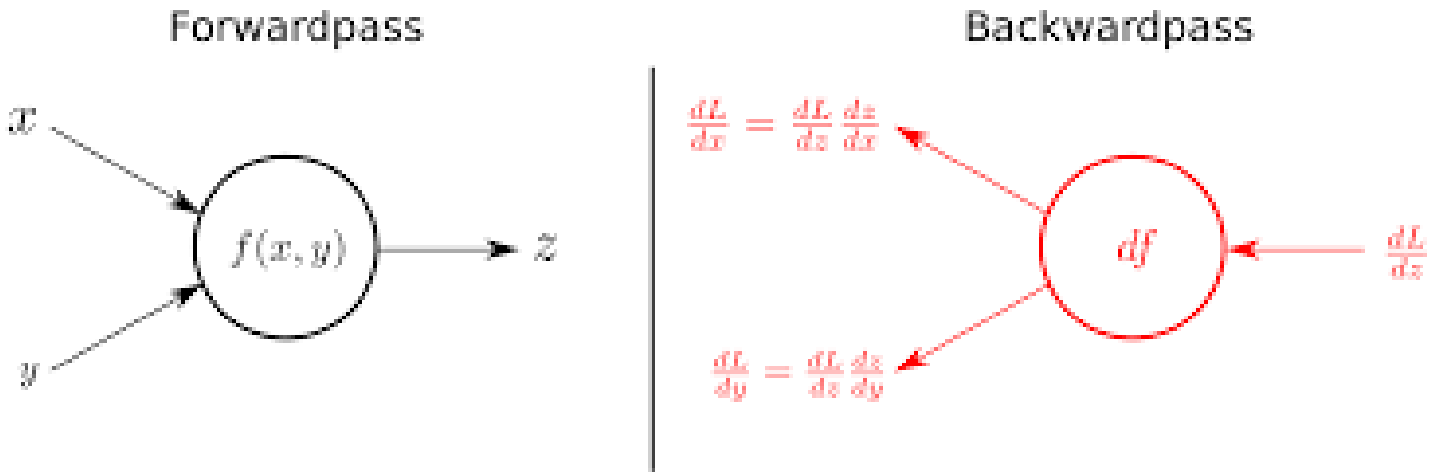
Forward and Back Propagation?



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What is Keras & TensorFlow

TensorFlow is an end-to-end open source platform for machine learning. It's a comprehensive and flexible ecosystem of tools, libraries and other resources that provide workflows with high-level APIs. The framework offers various levels of concepts for you to choose the one you need to build and deploy machine learning models. For instance, if you need to do some large machine learning tasks, you can use the Distribution Strategy API in order to perform distributed hardware configurations and if you need a full production machine learning pipeline, you can simply use TensorFlow Extended (TFX). Some of the salient features are described below:

- Easy Model Building
- Robust ML Production Anywhere
- Powerful Experimentation For Research

Keras on the other hand, is a high-level neural networks library which is running on the top of TensorFlow, CNTK, and Theano. Using Keras in deep learning allows for easy and fast prototyping as well as running seamlessly on CPU and GPU. This framework is written in Python code which is easy to debug and allows ease for extensibility. The main advantages of Keras are described below:

- User Friendly
- Modular and Composable
- Easy To Extend
- Easy To Use

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