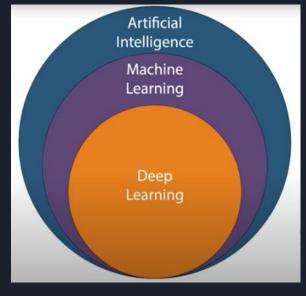
Statistical Simulation #7

Basic Terms

Artificial Intelligence(AI) is just using algos and stuff to mimic human brain for its intelligence.

Both ML, and Deep Learning fall under AI, and Deep Learning under ML.

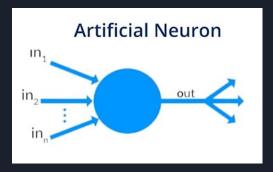


To be able do this we require some tools:

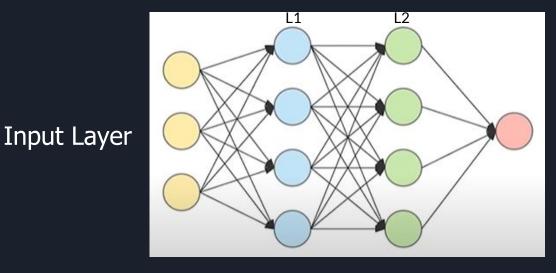
Just the usual subset relationship

- Deep Learning Frameworks:
 - > PyTorch
 - TensorFlow [Library for multiple ML tasks]
 - Keras [High-Level NN library, run on top of TF]

- Simple Artificial Neuron :
 - think of it as a basic coding unit
 - processes the data as a biological neuron



Artificial NN: contains input, output, several hidden layers



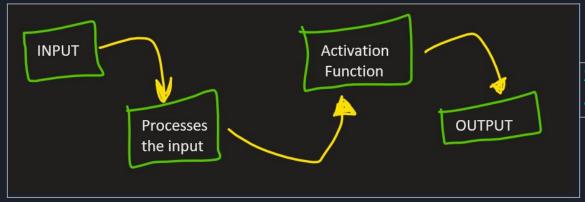
Output Layer

Hidden Layers [where processing is done]

- Artificial Neural Network
 - > Computing model
 - > Can learn from data
 - > Layers of connected nodes

Machine Learning	Deep Learning
Uses numerical and statistical approaches to encode learning in models	Learning data using representations (specific to one task)
 Supervised (using Labels) Unsupervised (just forming groups) Reinforcement Learning(by awarding a certain favourable outcome and penalizing the un-required one) 	Deep refers to number of hidden layers. It has capacity to learn features without manual interaction [Feature extraction]
more data give rise to inaccuracy	just favours(performs better than ML model)

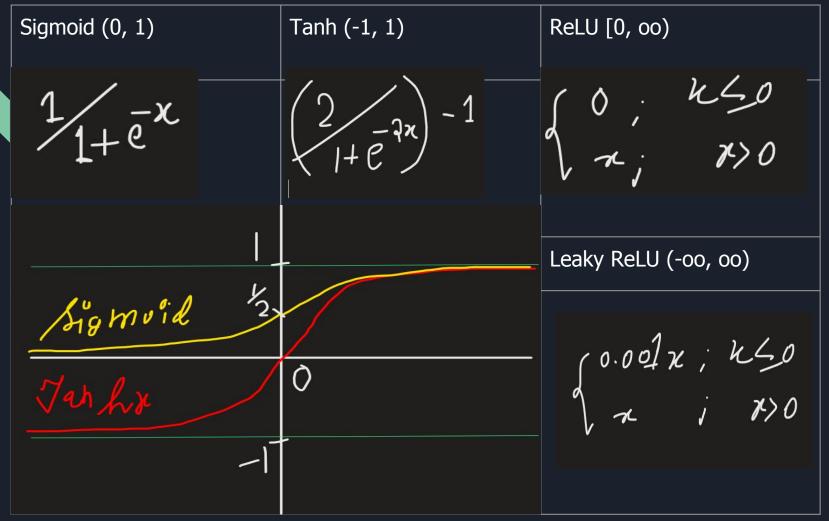
Basic Structure of a Artificial Neuron:



Such artificial neurons are called Perceptrons.

- Basic Qualities of a Perceptron:
 - It is just a Linear Model [Single Layered]
 - > It is a binary model
 - > so it can only be used for classification where the number of outcomes are 2(binary : 0/1).
 - ➤ Its Activation function is just the weighted sum of Input Data.

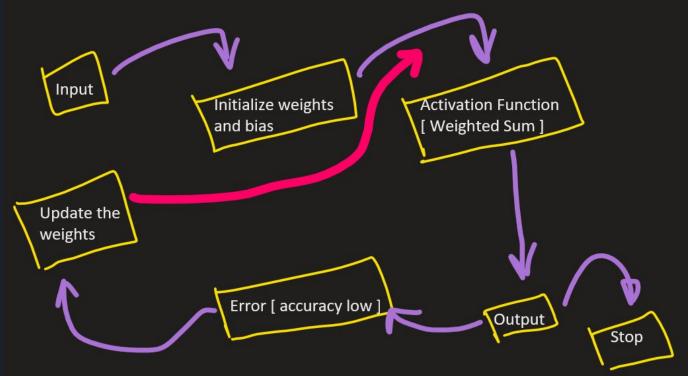
Input	Possible features of a data [X1, X2, , Xn]	
Weights	just the importance of the feature [W1, W2, , Wn]	
	Eg: [consider 2 features] : [it might rain today] : [good food in mess] We want to predict whether it'd rain or not. We see second feature doesn't make sense at all, so its weight will be comparatively less than other features to bring down its importance.	
Activation Function	Helps to convert LINEAR equation to non-linear, name of such Functions: Sigmoid, tanh, ReLU, SoftPlus etc. [will be explained]	
Bias	This is just used to shift the Activation function which can be done by adding a constant to the input	
	[In case of Perceptron, Activation Function is just the weighted sum] [So if the weighted sum for the data is say largely negative so we can just add a positive value to bring it in some favourable range or so]	



Meaning of Training a Perceptron: to find a LINE or PLANE or some HYPERPLANE; which can accurately separate the classes by adjusting the weights and bias [Binary classification]

Learning Rate: tuning parameter in an optimization algorithm,

it is just the step size (like h in integration) at each iteration while moving toward a minimum of a loss function.



Wi = Wi - Learning Rate*(Actual value - Perceptron output)*Xi

TensorFlow

Developed by GOOGLE, Open Source

NLP, Forecasting, Google Translate, Text Classification

TensorFlow provides us with 2 tools:

- TensorBoard: tool for providing the measurements and visualizations needed during the machine learning workflow. It enables tracking experiment metrics like loss and accuracy, visualizing the model graph, projecting embeddings to a lower dimensional space, and much more.
- ➤ **TensorFlow Serving**: TensorFlow Serving is a flexible, high-performance serving system for machine learning models, designed for production environments. TensorFlow Serving makes it easy to deploy new algorithms and experiments, while keeping the same server architecture and APIs.

Tensors:

- Nothing just multi-dimensional arrays where data is stored
- Input is given as tensors

Tensor Rank:

Nothing just Dimension of the multi-dimensional array

Tensor Rank	Example	Mathematical Nature
0	Distance (s) = 35	Constant [no direction]
1	v = 2i + 3j + 4k	Vector [magnitude + direction] [1D]
2	Matrix = [[1, 2, 3], [3, 4, 5]]	2D list like structure

DATA is stored as Tensors, while execution/computation is done as graphs.

F = a + (b*c). Then; Computational Graph: Multiplication

Here: Wodes -> mathematical operations.

Type -> Tensor.

- Program Elements in TensorFlow:
 - Constants: have same value
 - Placeholders: we can assign data to a variable at a later stage
 - Variables: like trainable parameters

- Useful Links Regarding TensorFlow:
 - Installation of TensorFlow
 - Cuda Toolkit installation
 - How to create Virtual Environment
 - TensorFlow versions compatibility