Artificial Neural Networks (ANN)

"Artificial Neural Networks mimic human brains."

- The neural networks are the model that how neurons in the human brain behave.
- ANN (Artificial Neural Network) copy the working of the human brain neurons or cells inside the computers.
- The greatest thing of ANN is it can extract the features of data without any programming or input.
- The computer can learn, recognise, and make decisions like human beings.

The neural network works on machine learning algorithms to fulfil the need of the user or perform the task.

It basically used to solve the problems for large dataset.

The traditional Machine Learning algorithm cannot improve the performance of the model after certain levels and then saturation will start.

Whereas Small ANN performs better than as Medium and Large Neural Network dataset.

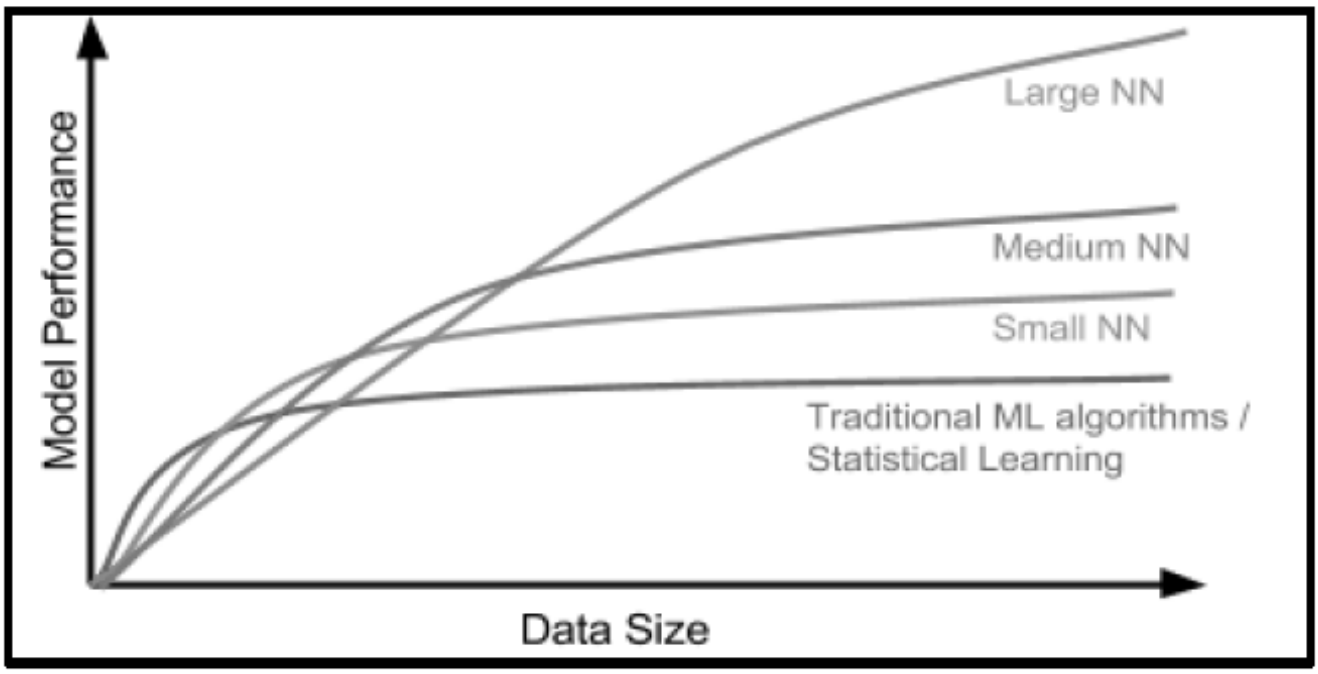


Image Credit – AI CBSE Curriculum Handbook

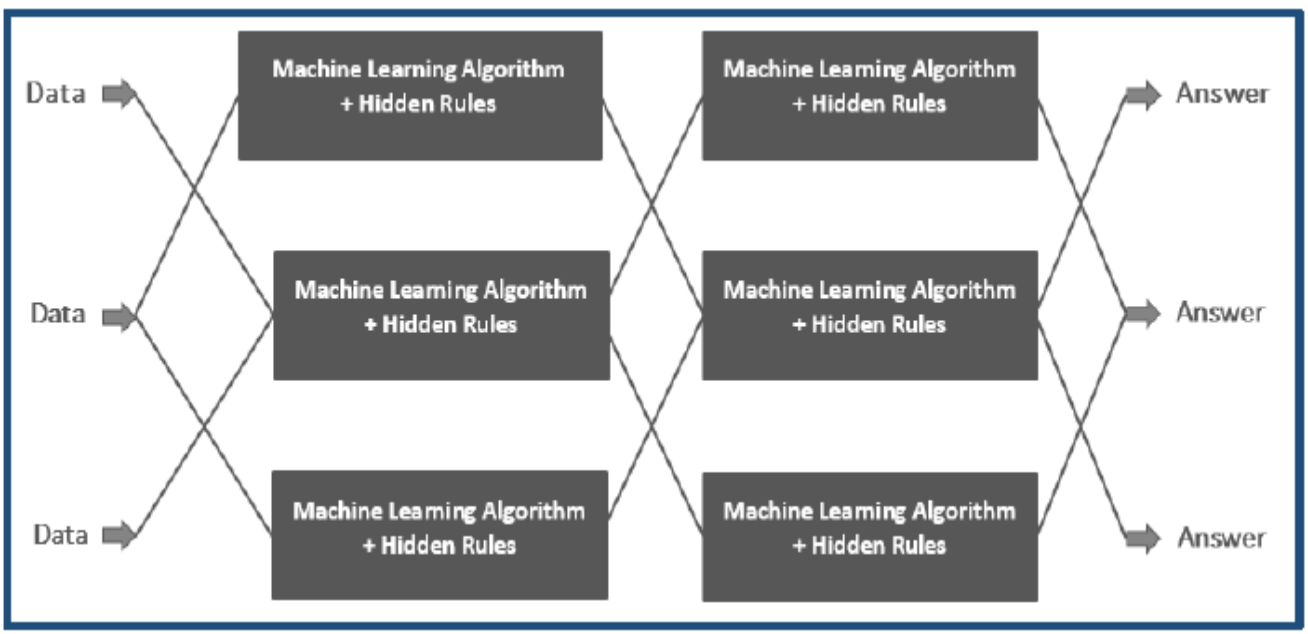
Artificial Neural Networks vs. Natural Neural Network

ANN	NNN
Node	Equivalent Of Neuron
Weighted Inputs	Equivalent To Dendrites
Activation Function	Equivalent To Soma (cell body) .
Connection from a Node To Another Node	Synapse
Output	Axon

- **Node** (or neurode) ←===→ neuron
- **weighted inputs** ←===→ dendrites
- **activation function** ←===→ soma or cell body
- **output** ←===→ axon.

How neural network works?

Observe the image given below:



This image shows that neural network is divided into different layers and each layer is divided into a block that accomplish its own task and then passes to the next layer.

There are three types of layers in an ANN:-

1. Input Layer –

- The first layer of a Neural Network is called the input layer, whose role is to acquire data and feed it to the Neural Network.
- The input layer carries out no processing, it just takes the input data & passes it on to the next connected layer.

2. Hidden Layer –

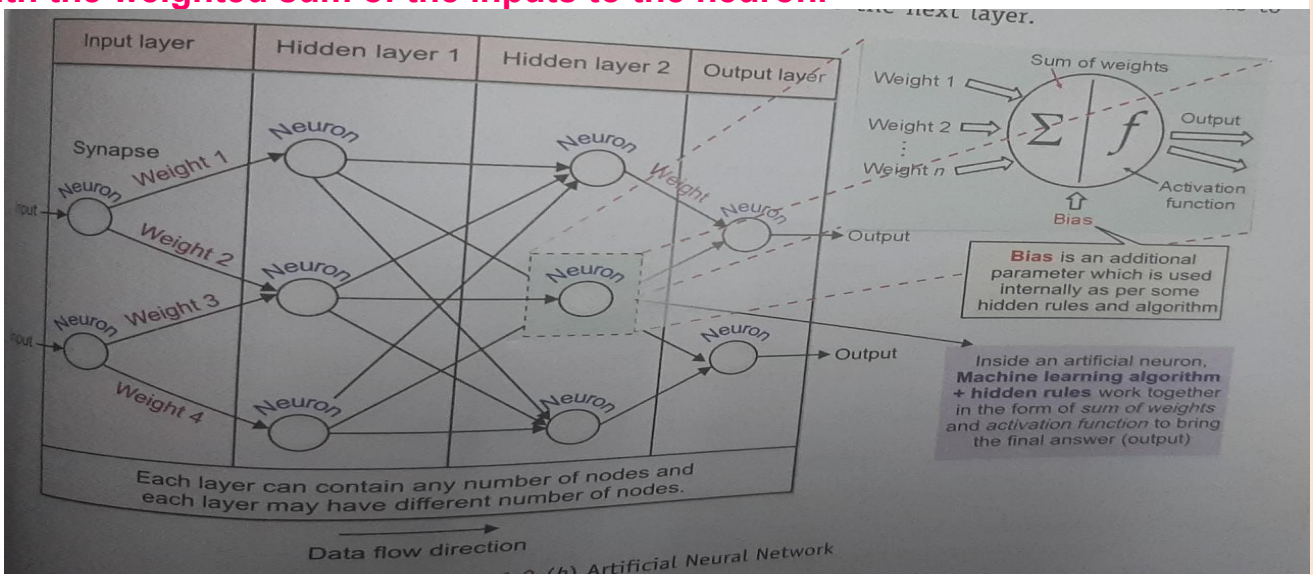
- Input layer is connected to hidden layer, which is further connected to other hidden layers or to the final output layer.
- The role of hidden layers is to process the inputs and carry out a task.
- **The processing at hidden layer is carried out as –**
  - ✓ Sum of weighted inputs.
  - ✓ Activation function (i.e. machine learning algorithm)
  - ✓ Hidden rules (such as getting additional parameters such as a bias).
  - ✓ There can be multiple hidden layers in an ANN, depending upon the complexity of the tasks being performed.
  - ✓ Hidden layers are not visible to user. The processed output of a hidden layer is then fed to the subsequent hidden layer of the network.
  - ✓ Each layer of an ANN can contain any number of nodes and each layer may have different number of nodes.

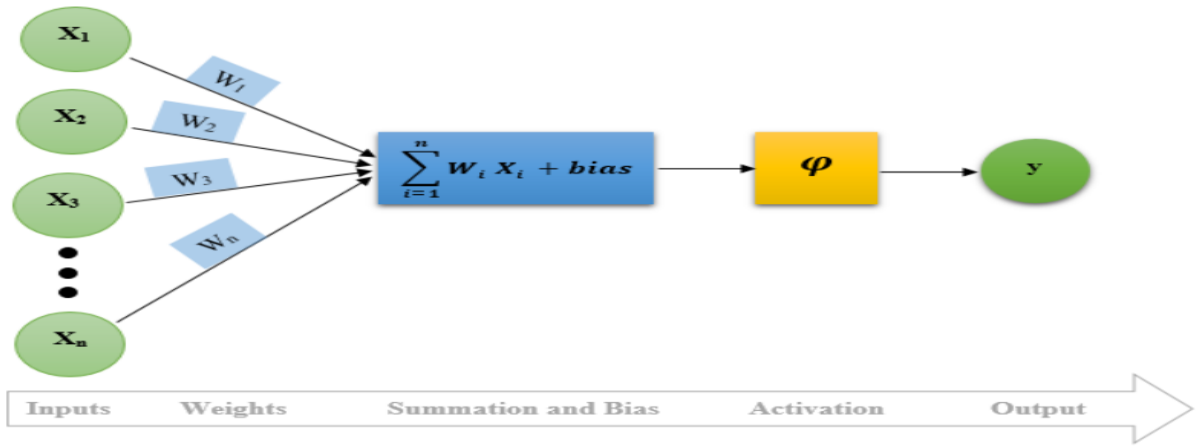
3. Output Layer –

- After processed data travels through multiple hidden layers, it is finally fed to the final layer known as output layer.

The output layer simply provides the final output to the user. At the output layer, no processing takes place, it only provides user-interface for the output.

Bias – it is an additional parameter in the Neural Network which is used internally as per some hidden rules and algorithm to adjust the output along with the weighted sum of the inputs to the neuron.





Artificial neural cell [8]

of the input is transformed into an output from a node or nodes in a layer of the network.

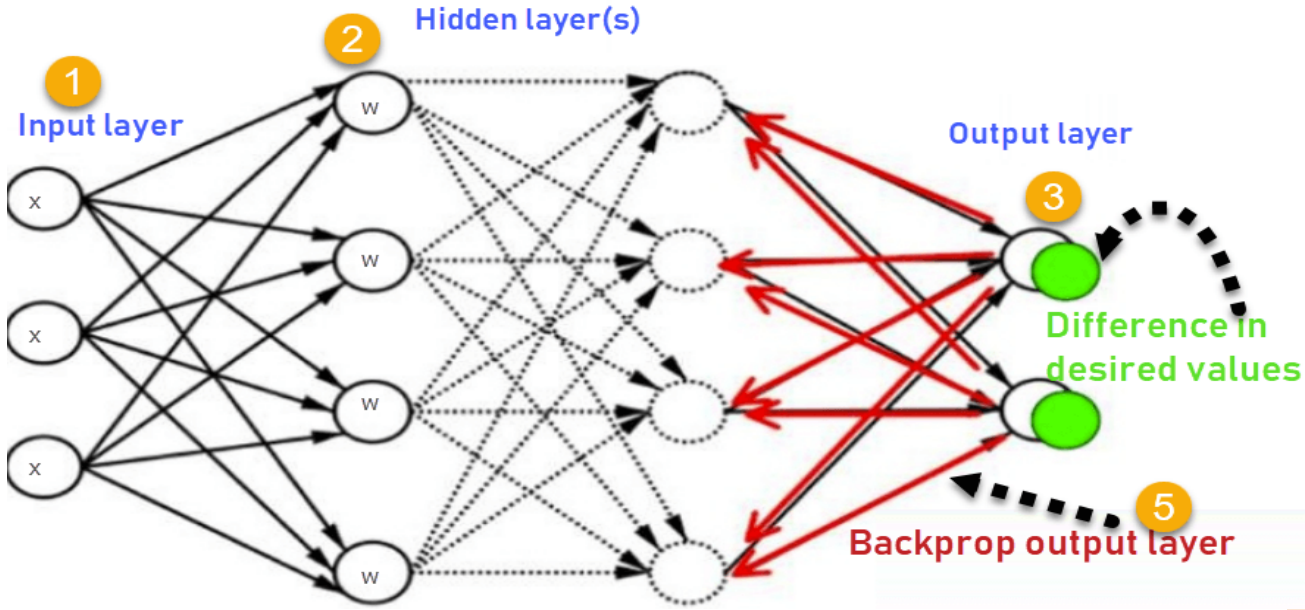
FACTS

The most ground-breaking aspect of neural network is that once trained, they learn on their own and they can work with big data sets. In this way, they emulate human

- **Like Human Brain, when we provide an input or feedback about the expected output, the brain registers it and modifies its way to reach at that conclusion.**

- **Based on the received feedback about the difference from the correct output, the neurons in ANNs makes changes in the weights or bias to be used with activation function so that they can reach to the correct output.**

Back Propagation – providing feedback about the difference from the correct output is known as back propagation.

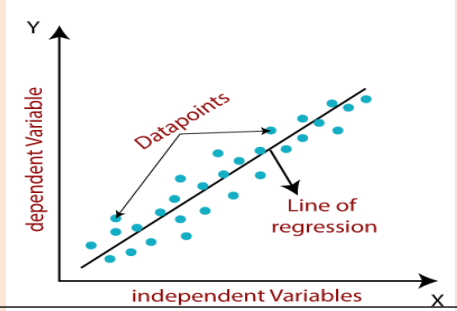
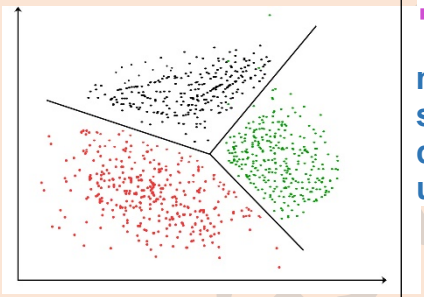


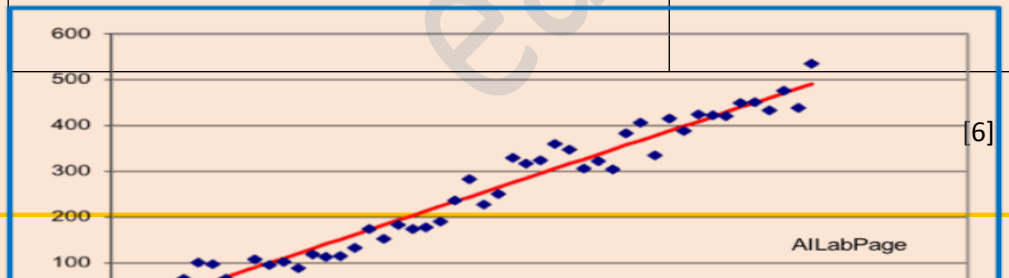
Features of Neural Network

- **Neural Network have been developed to mimic the structure and working of human brains.**
- Neural networks evolved and **automatically learn** with each input and each new attempt.
- Neural Networks can work **with big data sets.**
- The Neural Networks employ **machine learning techniques** to function and evolve.

Neural Network and AI Model - The Neural Networks have become popular as these can be used with various types of AI models.

1. Regresssion
2. Classification
3. Clustering

Regression [Supervised Learning Model], 	➔ It is a type of rule based AI model. ➔The goal of regression model is to build a mathematical equation from the available set of input data to produce the output. ➔The mathematical equation is called the mapping function, which with the help of new input can predict the possible output. use continuous data sets	E.g. If we have a data available about the drainage system, sanitation and cleanliness in an area and the number of dengue cases we can use this data to train an AI model and in future we can predict the possibility of dengue cases using the data of an area.
Classification	➔This is also a type of rule based AI model. ➔This AI model uses rules and labelled data sets to classify data sets into categories.	e.g. if we want to train a model to identify to image of a specific alphabet we need to train it with multiple image of alphabet along with their level. The machine will then classify the image on the basis of the level and predict the correct level for testing data. Classification model use non-continuous i.e. discreet data sets.
Clustering 	➔This is a machine learning approach model. ➔Clustering is a way to group a set of data point in a way that similar data points are grouped together. It is a un-supervised learning method .	e.g. a clustering can be a input a data set of customers buying details in past one year; it can then identify the customers who shopped the most, the customers who preferred buying certain type of things, the customers who only brought essential items and so on. it se non continuous i.e. discreet data sets.



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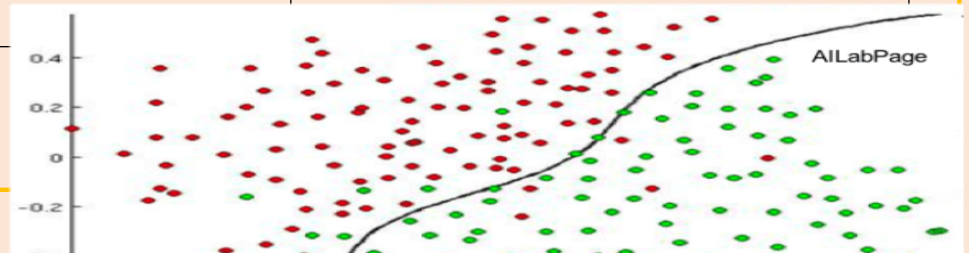

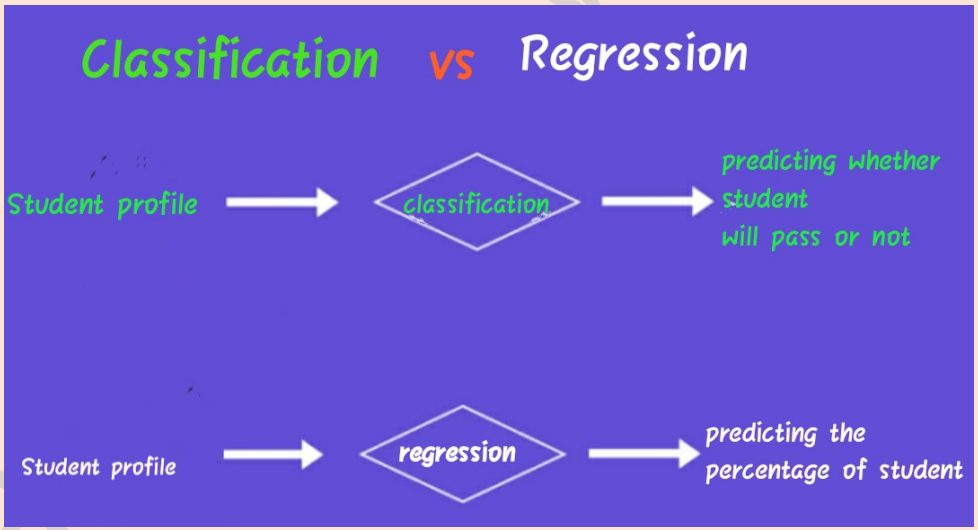
Classification vs Regression
Student profile
classification
predicting whether student will pass or not
Student profile
regression
predicting the percentage of student

Conclusion---

Deep Learning: It is the most advance form of machine learning where there are many hidden computational networks .

Artificial Intelligence: It refers to some kind of human like intelligent work or decision by machine
e.g. playing games like checkers and chess.

Machine Learning: It is an approach to AI in which an algorithm learns to make predictions from data i.e. fed into the system
i.e. traffic predictions map.

Artificial Neural Networks: It is a machine learning approach in which the algorithm process signals via
layers of interconnected nodes called artificial neurons I,e, Some popular application of neural networks are

- face recognitions,
- speech recognitions,
- self- driven vehicles,
- model diagnosis,
- auto suggestion based on search or shopping history and many others.