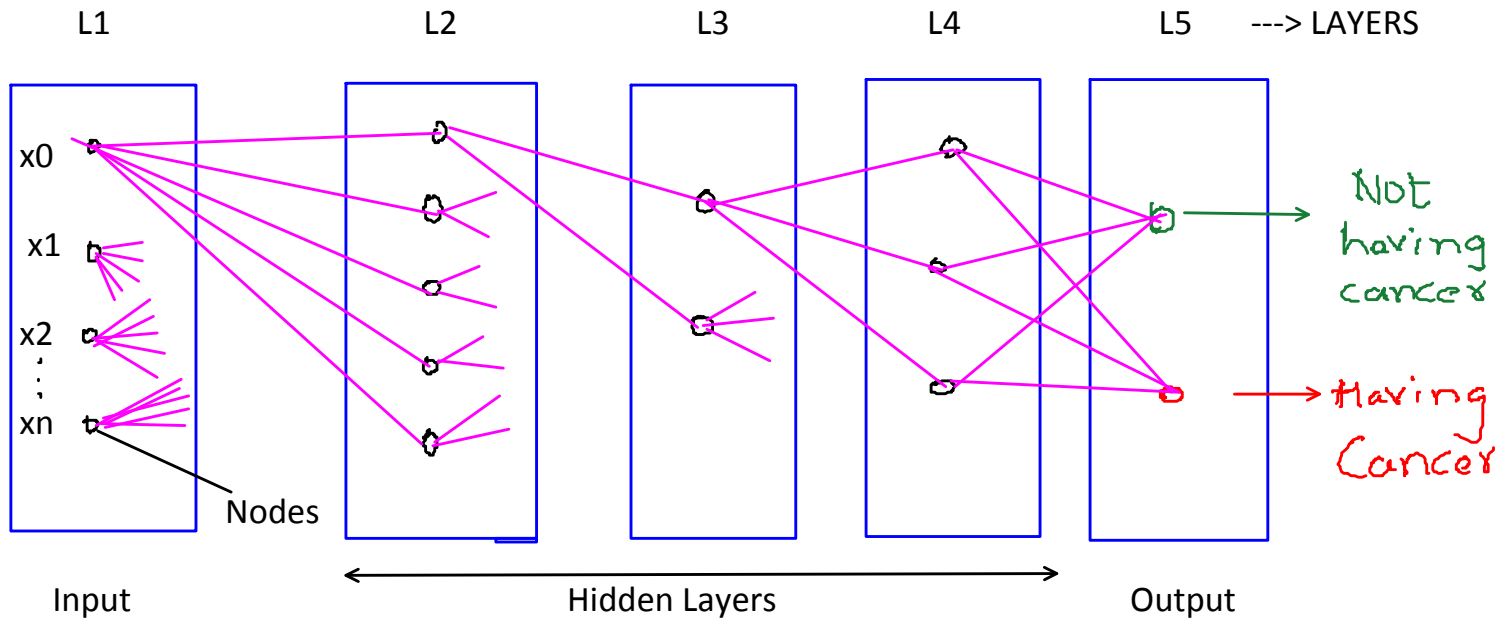


NEURAL NETWORK

★ The Below Network is called Neural Architecture or Tropology.



$$X = \begin{pmatrix} 1 & x_0 \\ \text{Age} & x_1 \\ \text{Wt} & x_2 \\ \text{income} & x_2 \end{pmatrix}$$

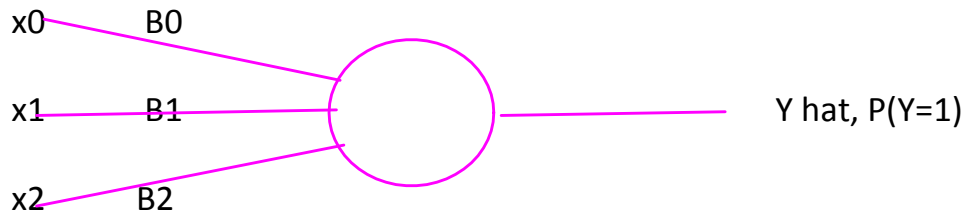
-----> Feature vector

-----> Age, weight, Income is called as Feature Components in Machine learning

- ★ Each row in a data set is called as one feature vector. Sample size is equal to the number of feature vectors.
- ★ The entire process will run for one observation for one time.
- ★ Only the input nodes and output nodes will match with our data set. Nodes is also called as Neurons.
- ★ Every Node will be connected with other node in other layer.
- ★ Neural Network is one of the method to divide the classes.
- ★ Neural Network is the method is used when you Y variable is either Continuous/Discrete.

- ★ Based on the problems we may include or we may not include hidden layers.
- ★ In the above, input layer will be not called as hidden layer, so it contains 4way hidden layers.
- ★ If we have only one layer in the whole network which is output layer. It is called Perceptron.

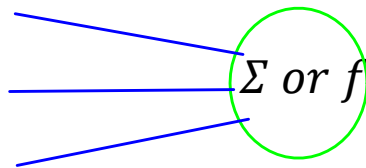
Single Output & Single Layer Perceptron



- ★ Here B_0 , B_1 , B_2 are called as weights.

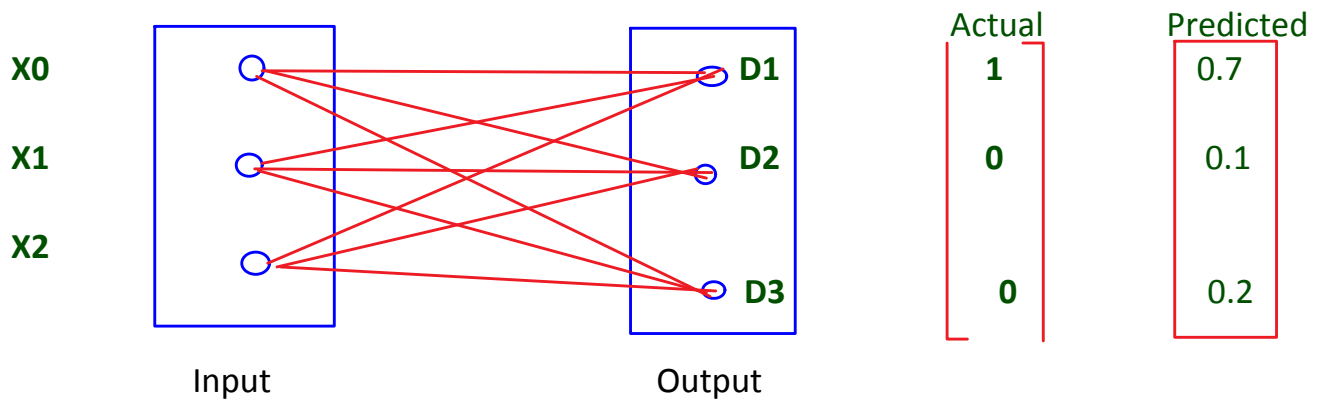
$$y = B_0 + B_1x_1 + \beta_2x_2$$

- ★ In every node or every Neuron, Two things/process are going to happen
 1. Summation (Σ)
 2. Activation (f)



- ★ If I calculate the $Y = B_0x$ and applied some function like $\frac{e^{x\beta}}{1+e^{x\beta}}$ Then the output is P_i will be calculated. The above function is called **Sigmoidal function** in NN.
- ★ In NN if we apply this function then the output becomes logistic regression. So logistic regression can be solved applying in NN.
- ★ So, NN is the extension or some part of the GLM.
- ★ So, NN is calculating the weights (B_0 , B_1 , B_2) by applying "Gradient Descent"

Multiple Outputs & Single Layer Perceptron



$$D1 = f(B_0 + B_1x_1 + \beta_2x_2)$$

$$D2 = f(\alpha_0 + \alpha_1x_1 + \alpha_2x_2)$$

$$D3 = f(\lambda_0 + \lambda_1x_1 + \lambda_2x_2)$$

As applied above, we have different types of functions are available here.

- Hard Thresholding
- Sig moidal
- Tan h^{-1}

Hard Thresholding:

$< 0.5 \text{ -----} > 0$

$> 0.5 \text{ -----} > 1$

- Above two are applicable if the classes are linearly separable.

★ There will some cases, when we keep on running the process it will never ends that means they are not able to linearly separable. Loops are running out infinite number of times.

Then we need to approach another method called "**Multi Layer Perceptron**"

NOTE: When the Responsible variable is Y is in categorical, we cannot apply regression then we will go for GLM. If the GLM is also not helping me even using the logistic regression. Then we need to approach the Neural Network Method.