Model of an artificial Neuron
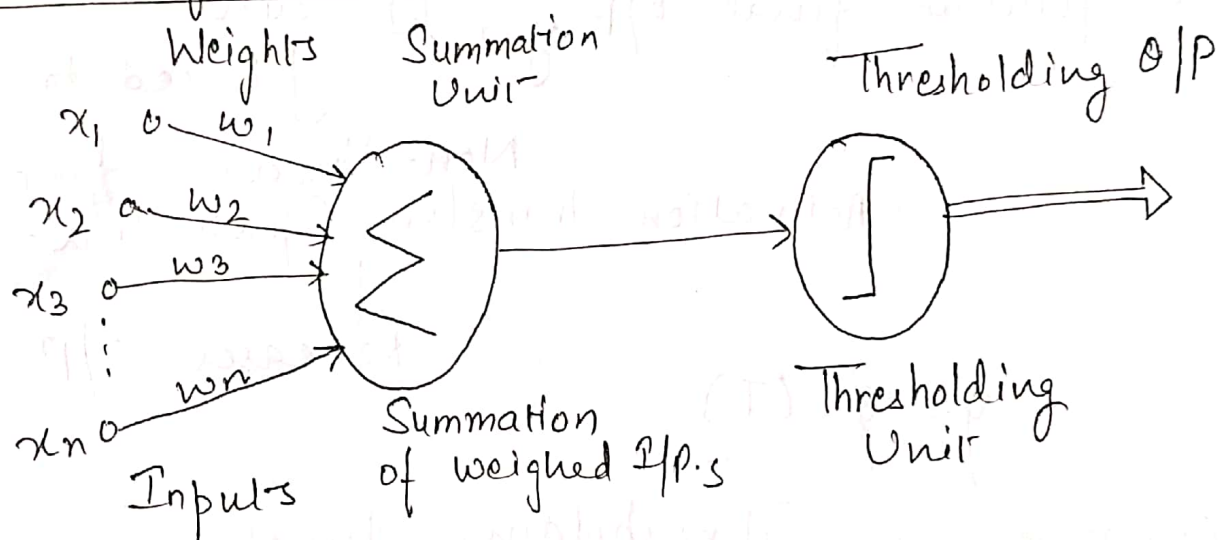
* **Human brain** is a highly complex structure
  |
  Highly interconnected n/w of ~~Stru~~ Neurons.

* **Artificial Neuron** :- Every Component of model bears a direct analogy to the actual constituents of a biological neuron..

* **Basis of NNs** .

Here $w_1, w_2, \ldots w_n \rightarrow$ weights of n I/P's $x_1, x_2, \ldots x_n$.

* A dendrite recieves all I/P.s, sums them & produces an o/p if sum > threshold value

* The I/P signal are passed on to cell body through synapse which may accelerate/retard an arriving signal.

* Acceleration / Retard. is modelled by weights.
* Effective Synapse → larger weight ⟶ Stronger signal.

* ∴ weights are multiplicative factors of I/P.

∴ Total Input (I) ⟶

$$I = w_1 x_1 + w_2 x_2 + \cdots + w_n x_n$$

$$I = \sum_{i=1}^{n} w_i x_i$$

* To generate final o/p y, (I) sum
Passed to
Non-Linear ϕ func.
(Activation, Transfer, Squash func.)
Releases o/p

$$y = \phi(I)$$

* Common is Thresholding func^n.
In this, if θ = threshold value

$$\phi(I) = \begin{matrix} 1 , & I > \theta \\ 0 , & else \ (I < \theta) \end{matrix}$$

$$y = \phi\left(\sum_{i=1}^{n} w_i x_i - \theta\right)$$

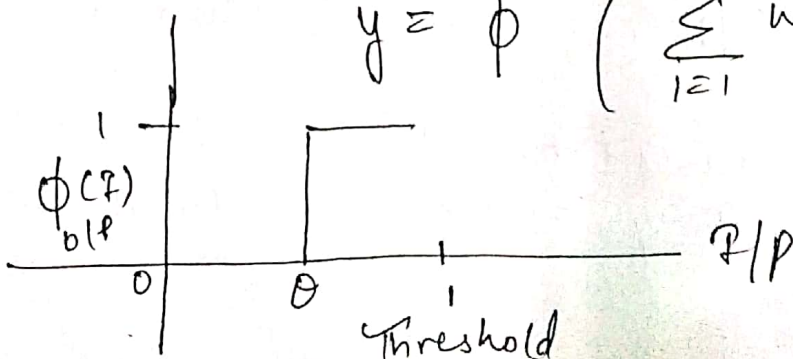fig: Thresholding func^n

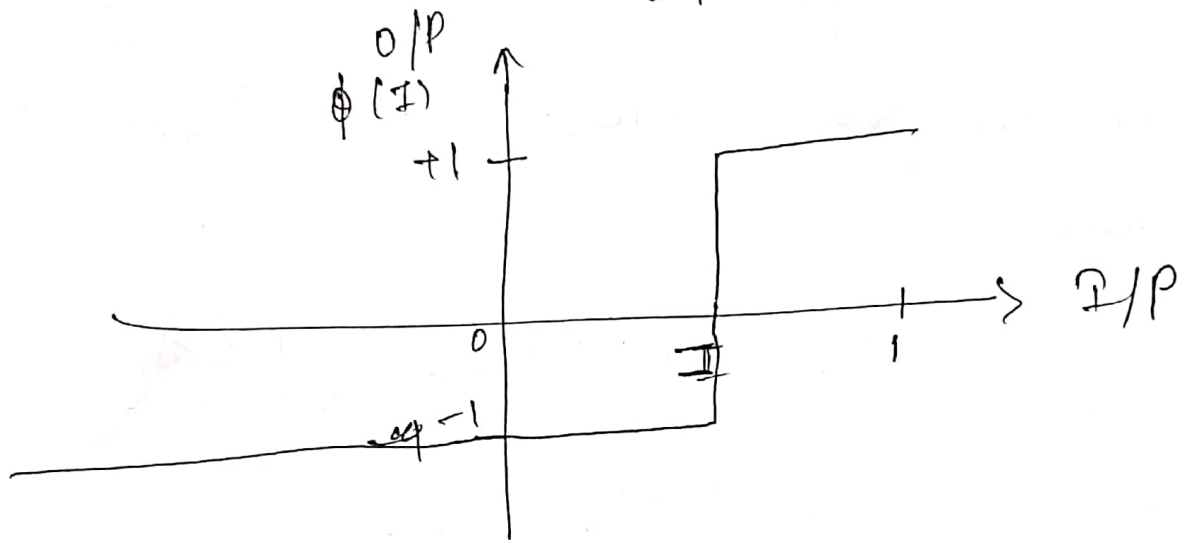$\phi(I)$
b/f
0
θ
Threshold
I/P

$\phi \rightarrow$ Step func^n. (Heavy side func^n)

Neuron on $\rightarrow 1$

off $\rightarrow 0$

Other Activation func.s —

Signum / Quantizer func^n —

$$\phi(I) = \begin{array}{ll} +1 & , \; I > 0 \\ -1 & , \; I \leq 0 \end{array}$$

o/p
$\phi(I)$
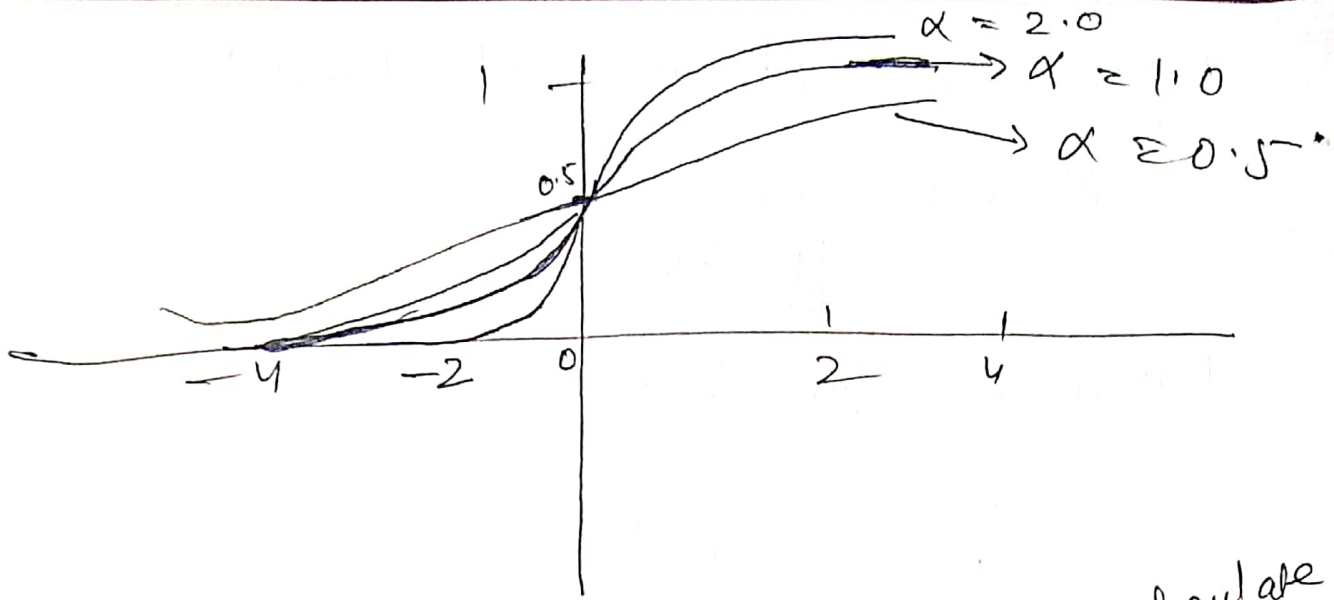
+1

0

$\rightarrow$ I/P

-1

Sigmoidal func^n :— Continuous func^n varies

b/w asymptotic values 0 & 1 or -1 & +1

$$\phi(I) = \frac{1}{1 + e^{-\alpha I}}$$

$\alpha =$ Slope parameter

$\downarrow$

adjusts abruptness of func^n as it changes
b/w two asymptotic values.

* Sigmoidal func^{n}s are differentiable.

α = 2.0
→ α = 1.0
→ α = 0.5

Hyperbolic Tangent funcⁿ

→ To calculate error effects on wgts.

$$\phi(I) = \tanh(I)$$

O/P for every value.

* Can produce -ve values.

~~* Basic unit~~

~~* 1st mo:~~

* 1st model (1943) → no learning just basic building block.

$$\frac{w \rightarrow \text{vary}}{I/P \text{ fixed} \quad x_0 = 1}.$$