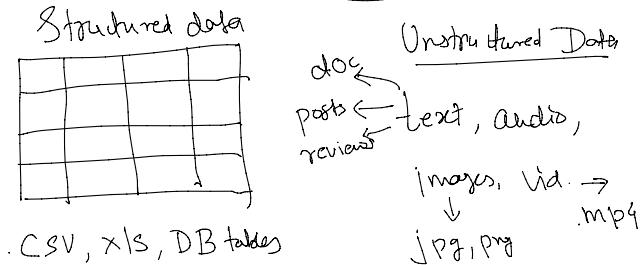
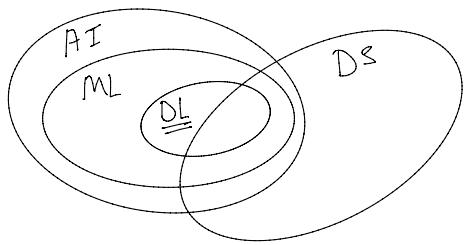


Deep Learning



Content → Artificial N.N.

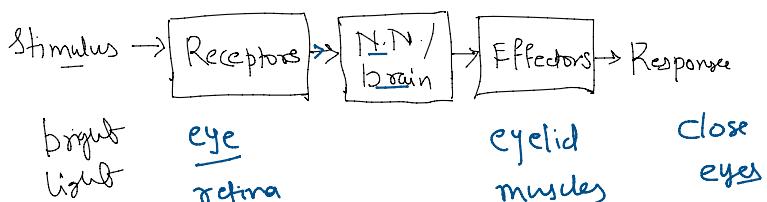
→ CNN
↳ Image

→ RNN
↳ Seq-to-seq

→ 2028 → DL: 400B\$

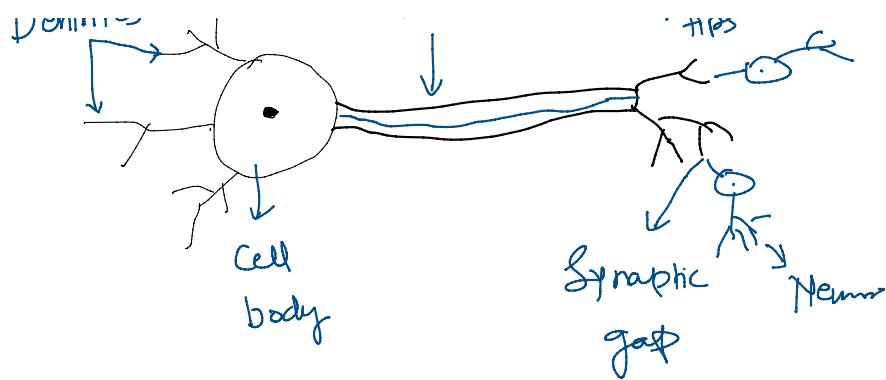
→ 15-20 yrs → DL: 30T\$

Human nervous system



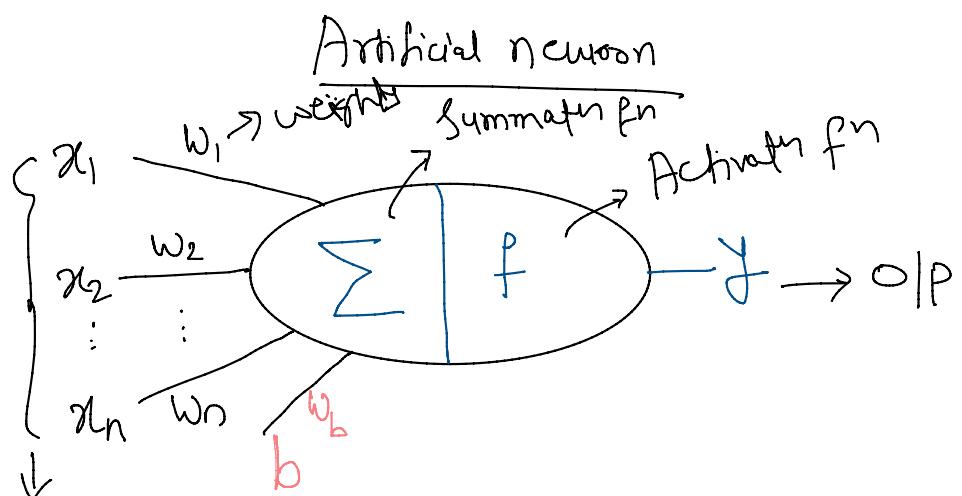
Biological neuron





No. of neurons $\rightarrow 10^6 - 10^8$

No. of synapses $\rightarrow 10^{11}$



iIP

Summation fn: Z

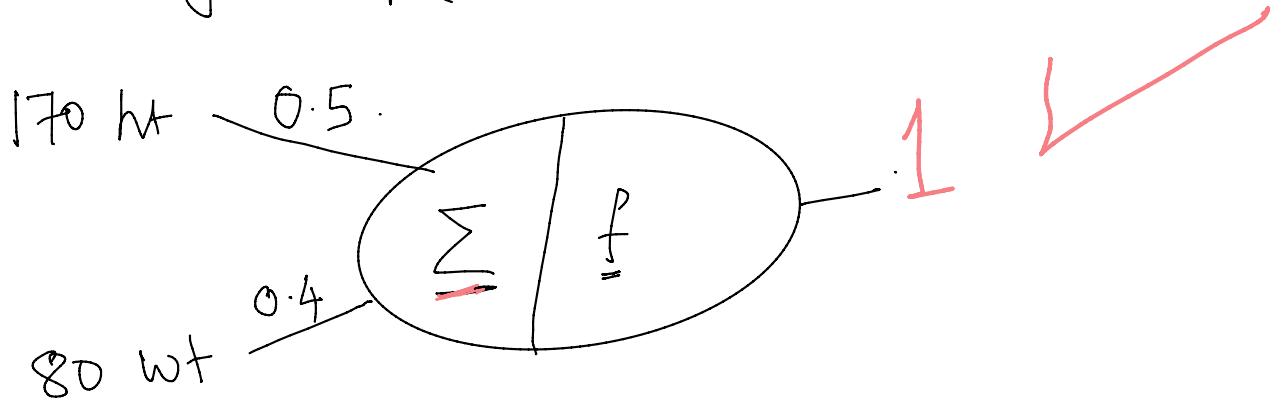
$$Z = x_1 \cdot w_1 + x_2 \cdot w_2$$

$$+ \dots + x_n \cdot w_n + b \cdot w_b$$

$$\text{For } w_b = 1$$

$$Z = \sum_{i=1}^n x_i \cdot w_i + b$$

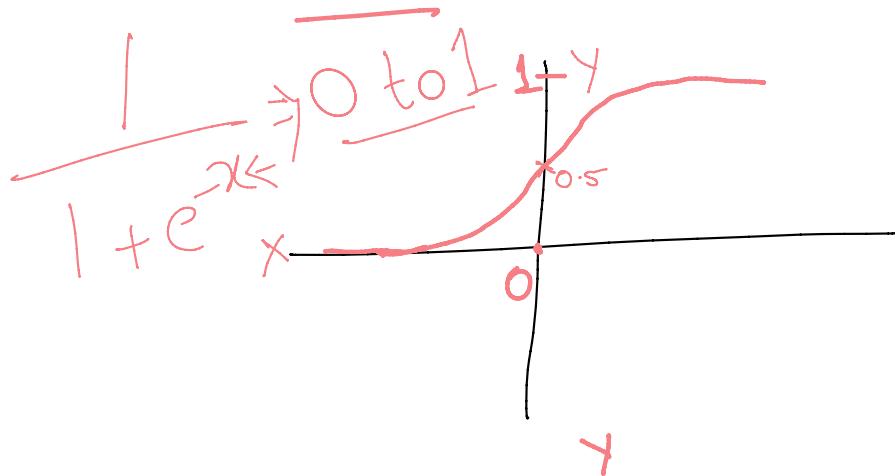
$$y = f(z)$$

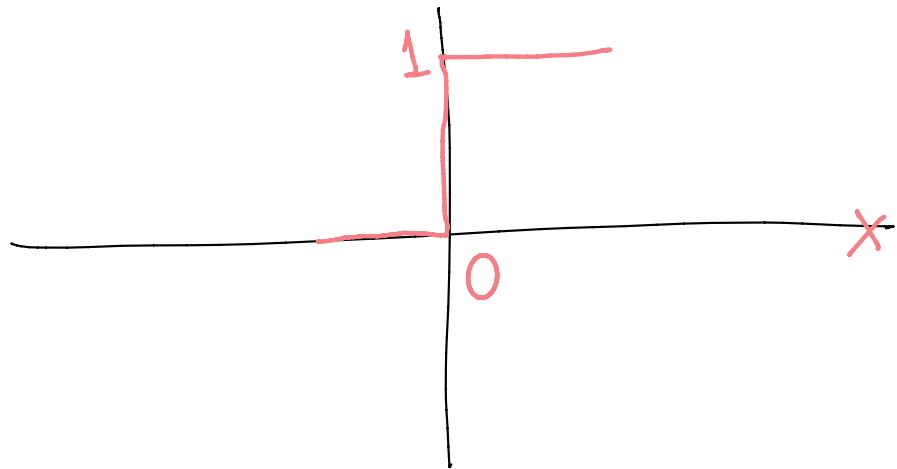


ht	wt	in.	gau	box	Outcome (y/n)
170cm	80kg				1 (0/1)

$$z = 170 \times 0.5 + 80 \times 0.4$$

$$= 117$$





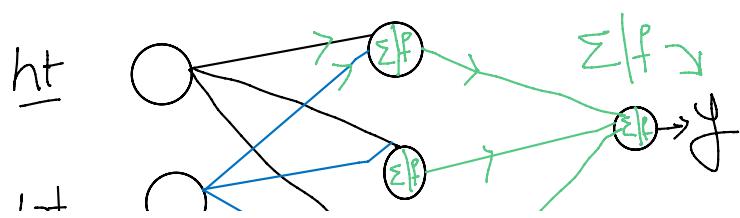
ht 170 wt 80

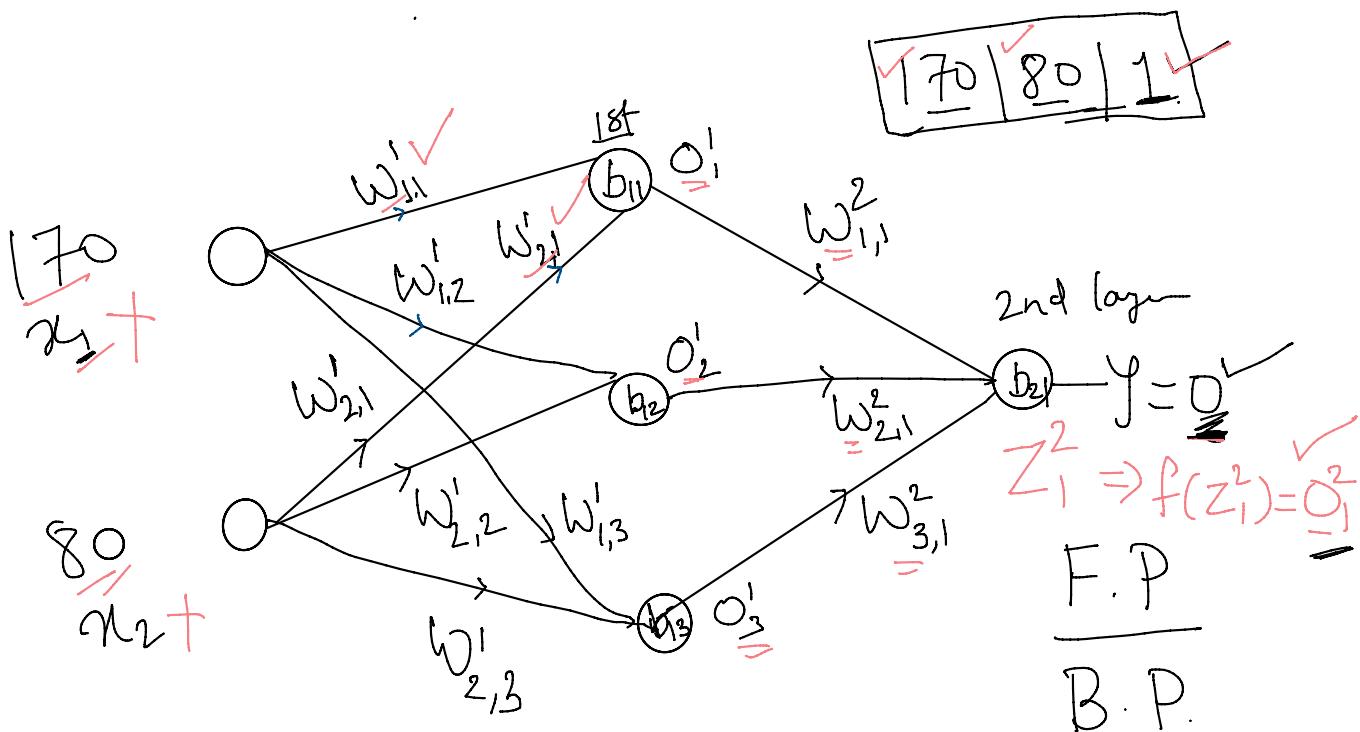
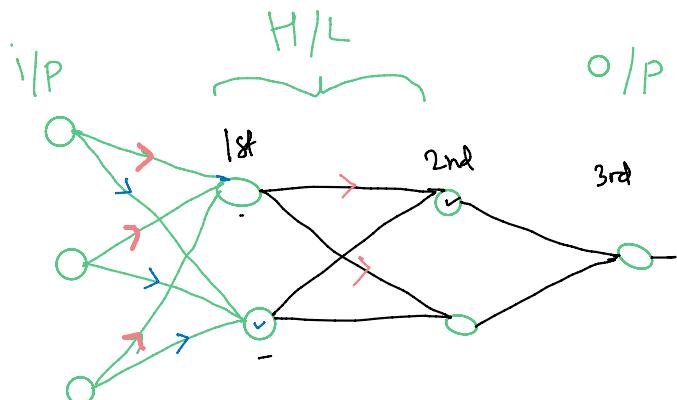
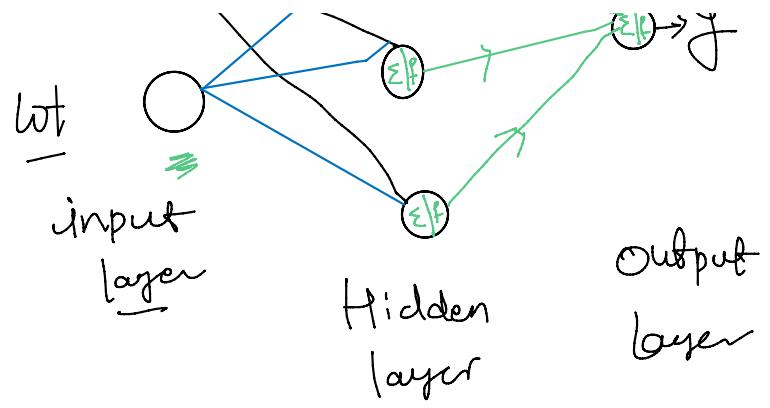
$$Z = 117 \quad f(x) \begin{cases} 1, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

Step fn (Z) = $f(117)$

$$= 1$$

ANN





$$y = \underline{m}x + \underline{c}$$

$$\omega^1_{\leftarrow, \rightarrow}$$

in:

$$\rightarrow z_1^1 = x_1 \cdot \omega_{11}^1 + x_2 \cdot \omega_{21}^1 + b_{11}$$

$$f(z_1^1) \Rightarrow o_1^1$$

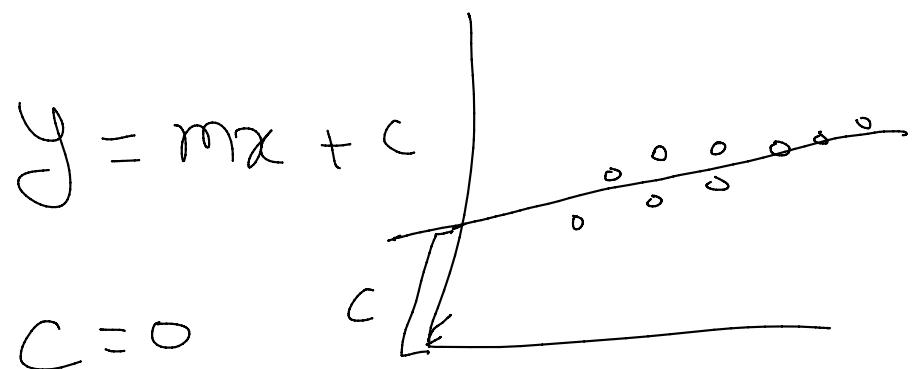
$$\rightarrow z_2^1 \Rightarrow f(z_2^1) = o_2^1$$

$$\rightarrow z_3^1 \Rightarrow f(z_3^1) = o_3^1$$

$$\underline{\omega}_{\text{new}} = \underline{\omega}_{\text{old}} - \eta \frac{\partial E}{\partial \underline{\omega}_{\text{old}}}$$

$$m = \frac{\partial E}{\partial m} + m$$

$$c = \frac{\partial E}{\partial c} + c$$



$$\underline{x} = \underline{\underline{w}}, \underline{\underline{b}} \quad \text{FP}$$

$$ML \quad \text{BP}$$

$$\underline{\underline{y}} = \underline{\underline{m}} \underline{\underline{x}} + \underline{\underline{c}}$$

See $\Sigma | f$