Date: Day:

Forward propagation (How a neural network predicts output =?

Backpropagation → Neural Network (Train)

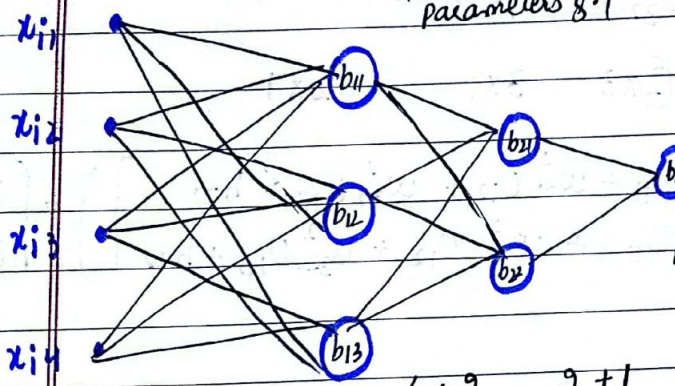
data (input) ---- layers (move) → through each layer

Backpropagation.

Weights update

training hoti hai

	cgpa	iq	10^{th} m	12^{th} m	placed
# of trainable parameters →	7.2	72	69	81	1
	8.1	92	75	76	0



prediction → $\sigma(w^T x + b)$

Layer #1

$$\begin{bmatrix} w'_{11} & w'_{12} & w'_{13} \\ w'_{21} & w'_{22} & w'_{23} \\ w'_{31} & w'_{32} & w'_{33} \\ w'_{41} & w'_{42} & w'_{43} \end{bmatrix} \times \begin{bmatrix} x_{i1} \\ x_{i2} \\ x_{i3} \\ x_{i4} \end{bmatrix} + \begin{bmatrix} b_{11} \\ b_{12} \\ b_{13} \end{bmatrix}$$

$(4)\times 3 \xrightarrow{T} 3\times(4)$ $\quad (4)\times 1$ $\quad 3\times 1$

new matrix 3×1

Date: Day:

$$= \begin{bmatrix} w_{11}^1 x_{i1} + w_{21}^1 x_{i2} + w_{31}^1 x_{i3} + w_{41}^1 x_{i4} \\ w_{12}^1 x_{i1} + w_{22}^1 x_{i2} + w_{32}^1 x_{i3} + w_{42}^1 x_{i4} \\ w_{13}^1 x_{i1} + w_{23}^1 x_{i2} + w_{33}^1 x_{i3} + w_{43}^1 x_{i4} \end{bmatrix} \begin{bmatrix} b_{11} \\ b_{12} \\ b_{13} \end{bmatrix}$$

$$= \sigma\left(\begin{bmatrix} w_{11}^1 x_{i1} + w_{21}^1 x_{i2} + w_{31}^1 x_{i3} + w_{41}^1 x_{i4} + b_{11} \\ w_{12}^1 x_{i1} + w_{22}^1 x_{i2} + w_{32}^1 x_{i3} + w_{42}^1 x_{i4} + b_{12} \\ w_{13}^1 x_{i1} + w_{23}^1 x_{i2} + w_{33}^1 x_{i3} + w_{43}^1 x_{i4} + b_{13} \end{bmatrix} \right)$$

$$= \begin{bmatrix} O_{11} \\ O_{12} \\ O_{13} \end{bmatrix}$$

Layer 02:

$$\begin{bmatrix} w_{11}^2 & w_{12}^2 \\ w_{21}^2 & w_{22}^2 \\ w_{31}^2 & w_{32}^2 \end{bmatrix} \cdot \begin{bmatrix} O_{11} \\ O_{12} \\ O_{13} \end{bmatrix} + \begin{bmatrix} b_{21} \\ b_{22} \end{bmatrix}$$

$3 \times (2) \xrightarrow{T} (2) \times 3 \quad 3 \times 1 \quad 2 \times 1$

$$= \sigma\left(\begin{bmatrix} w_{11}^2 O_{11} + w_{21}^2 O_{12} + w_{31}^2 O_{13} + b_{21} \\ w_{12}^2 O_{11} + w_{22}^2 O_{12} + w_{32}^2 O_{13} + b_{22} \end{bmatrix} \right) = \begin{bmatrix} O_{21} \\ O_{22} \end{bmatrix}$$

Layer 03:

$$\begin{bmatrix} w_{11}^3 \\ w_{21}^3 \end{bmatrix}^T \begin{bmatrix} O_{21} \\ O_{22} \end{bmatrix} + \begin{bmatrix} b_{31} \end{bmatrix}$$

$2 \times 1 \quad 2 \times 1 \quad 1 \times 1$

1×2

$$= \sigma\left(\begin{bmatrix} w_{11}^3 O_{21} + w_{21}^3 O_{22} + b_{31} \end{bmatrix} \right)$$

$$= \hat{y_i} = O_{31}$$

Date: Summary: Day:

$$a^{[1]} = \sigma(a^{[0]} w^{[1]} + b^{[1]})$$
$$a^{[2]} = \sigma(a^{[1]} w^{[2]} + b^{[2]})$$
$$a^{[3]} = \sigma(a^{[2]} w^{[3]} + b^{[3]})$$

$$\hat{y} = \sigma(\sigma((\underbrace{\sigma(a^{[0]} w^{[1]} + b^{[1]})}_{a^{[1]}}) w^{[2]} + b^{[2]}) w^{[3]} + b^{[3]})$$

$[a^{[2]}]$

$a^{[3]}$.