DL-22

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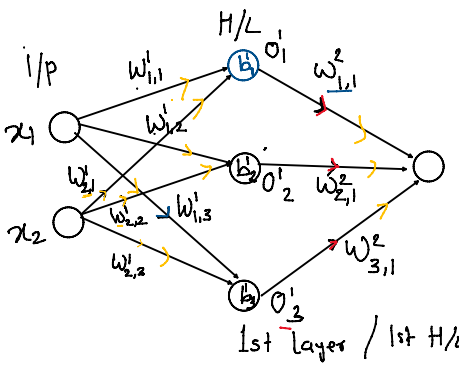



$w^k_{i,j}$ → layer, → destination, ← source

o/p → 1

9 wts

2 i/p

4 z, f

8

$$\frac{\partial E}{\partial w_1}$$

$$z^1_1 = x_1 \cdot w^1_{1,1} + x_2 \cdot w^1_{2,1} + b^1_1$$

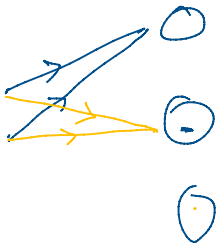
$$o^1_1 = f(z^1_1)$$

Similarly, calculate $z^1_2$ & $o^1_2$, $z^1_3$ & $o^1_2$

$$y = x \times w + b$$

Weight matrix

$$W = \begin{bmatrix} w^1_{1,1} & w^1_{1,2} & w^1_{1,3} \\ w^1_{2,1} & w^1_{2,2} & w^1_{2,3} \end{bmatrix}$$



$$W^T = \begin{bmatrix} w^1_{1,1} & w^1_{2,1} \\ w^1_{1,2} & w^1_{2,2} \\ w^1_{1,3} & w^1_{2,3} \end{bmatrix}$$

Input matrix

$$X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Bias matrix

$$B = \begin{bmatrix} b_1' \\ b_2' \\ b_3' \end{bmatrix}$$

$$Z = W^T \cdot X + B$$


$$f(Z) = f(W^T \cdot X + B)$$

$W^T * X \Rightarrow$

$$\begin{bmatrix} w_{1,1}' & w_{2,1}' \\ w_{1,2}' & w_{2,2}' \\ w_{1,3}' & w_{2,3}' \end{bmatrix} * \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} x_1 \cdot w_{1,1}' + x_2 \cdot w_{2,1}' \\ x_1 \cdot w_{1,2}' + x_2 \cdot w_{2,2}' \\ x_1 \cdot w_{1,3}' + x_2 \cdot w_{2,3}' \end{bmatrix}$$

What is the prerequisit for matrix multiplut

$W^T * X \quad + \quad B$

$$Z = \begin{bmatrix} x_1 \cdot w_{1,1}' + x_2 \cdot w_{2,1}' \\ x_1 \cdot w_{1,2}' + x_2 \cdot w_{2,2}' \\ x_1 \cdot w_{1,3}' + x_2 \cdot w_{2,3}' \end{bmatrix} + \begin{bmatrix} b_1' \\ b_2' \\ b_3' \end{bmatrix} = \begin{bmatrix} x_1 \cdot w_{1,1}' + x_2 \cdot w_{2,1}' + b_1' \\ x_1 \cdot w_{1,2}' + x_2 \cdot w_{2,2}' + b_2' \\ x_1 \cdot w_{1,3}' + x_2 \cdot w_{2,3}' + b_3' \end{bmatrix}$$

$170 \times 0.4 + 0.3$

$$f(Z) = ReLU\left( \begin{bmatrix} x_1 \cdot w_{1,1}' + x_2 \cdot w_{2,1}' + b_1' \\ x_1 \cdot w_{1,2}' + x_2 \cdot w_{2,2}' + b_2' \\ x_1 \cdot w_{1,3}' + x_2 \cdot w_{2,3}' + b_3' \end{bmatrix} \right)$$

$$= ReLU\left( \begin{bmatrix} 66 \\ -30 \\ 41 \end{bmatrix} \right)$$

$$= \begin{bmatrix} 66 \\ 0 \\ 41 \end{bmatrix}$$

$$ReLU(z) = \begin{cases} 0, & z \le 0 \\ z, & z > 0 \end{cases}$$

$$f(z) = ReLU\left(\begin{bmatrix} 57 \\ -60 \\ 70 \end{bmatrix}\right)$$

$$= \begin{bmatrix} 57 \\ 0 \\ 70 \end{bmatrix}$$

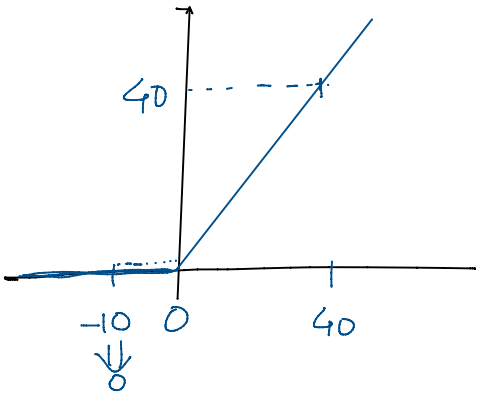

- I/p ⇒ values from D.S.
- H/L ⇒ ReLU
- O/L ⇒ Regression ⇒ Linear
  - clf (binary) ⇒ Sigmoid
  - clf (multi-class) ⇒ Softmax

ReLU

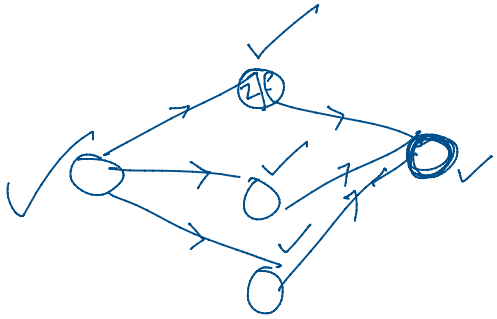
$$f(-40) = \begin{cases} 0, & x < 0 \\ x, & x \ge 0 \end{cases}$$

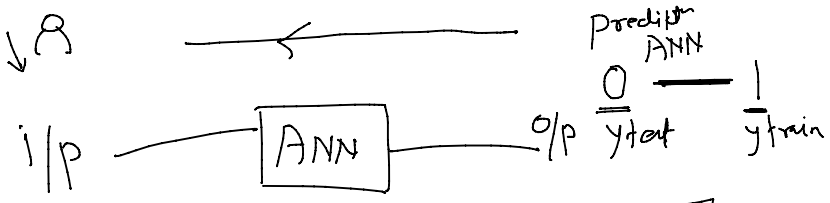
$$= 0$$

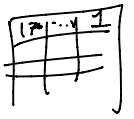
$z = -40$





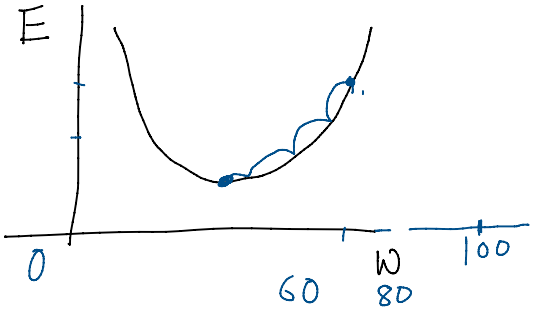




$$W_{new} = W_{old} - \eta^* \frac{\partial E}{\partial W_{old}}$$

4N+4B



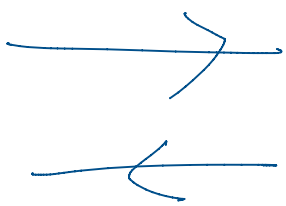

1 N.

1 Wt

E →

$x \cdot w + b$

↓ change in $w \Rightarrow E$



$x_i$ w 1

0/255 = 0 0 to 1

10/255 0.02
0.1
0.36

⋮

255/255 = 1