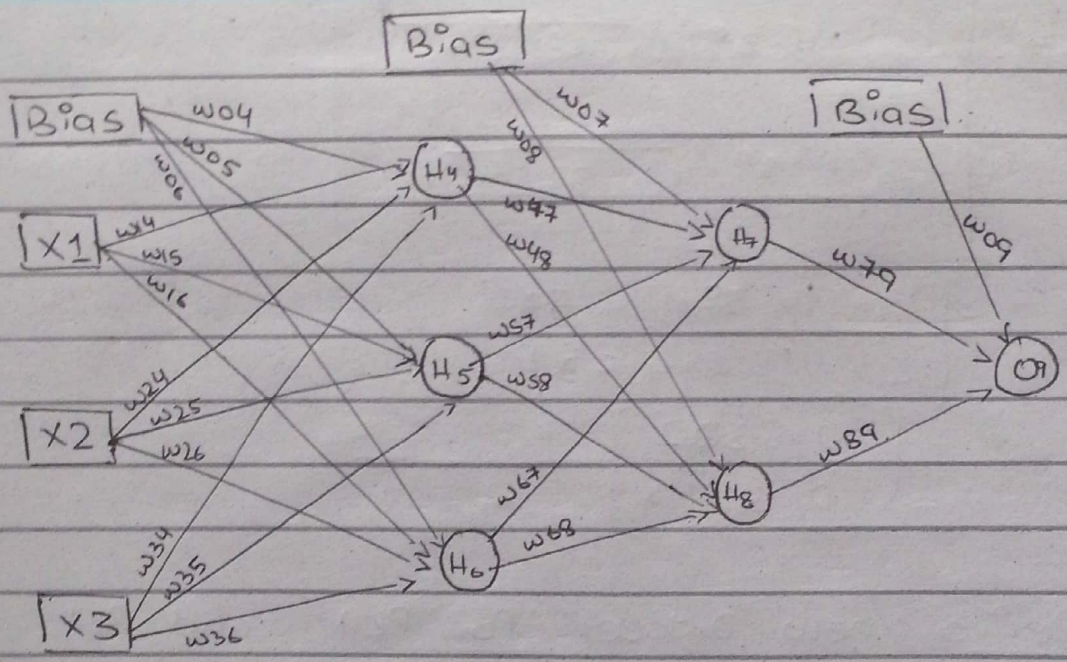
FeedForward BackPropagation ANN



$x_1 = 1$, $x_2 = 0$, $x_3 = 1$

output = 1.

learning ~~weights~~ rate = 0.5

Initial weights :-

Hidden layer 1:-

$w_{04} = 0$, $w_{05} = 0$, $w_{06} = 1$, [redacted]

$w_{14} = 0$, $w_{15} = 0$, $w_{16} = 3$

$w_{24} = 0$, $w_{25} = 1$, $w_{26} = 0$

$w_{34} = 0$, $w_{35} = 0$, $w_{36} = 0$.

Hidden layer 2:-

$w_{07} = 0$, $w_{08} = 0$ $w_{57} = 0$, $w_{58} = 1$

$w_{47} = 2$, $w_{48} = 0$ $w_{67} = 1$, $w_{68} = 0$.

Output layer :-

$w_{09} = 1$

$w_{79} = 0$

$w_{89} = 1$.

→ FeedForward:-

$H_4 = (bias \times w04) + (x1 \times w14) + (x2 \times w24) + (x3 \times w34)$

$= 0 + 0 + 0 + 0$

$= 0.$

sigmoid $H_4 = \frac{1}{1+e^{-x}} = \frac{1}{1+e^{-0}} = \boxed{0.5}$

$H_5 = (bias \times w05) + (x1 \times w15) + (x2 \times w25) + (x3 \times w35)$

$= 0 + 0 + 0 + 0$

$= 0.$

sigmoid $H_5 = \boxed{0.5}$

$H_6 = (bias \times w06) + (x1 \times w16) + (x2 \times w26) + (x3 \times w36)$

$= 1 + (1 \times 3) + 0 + 0.$

$= 4.$

Sigmoid $H_6 = \frac{1}{1+e^{-4}} = \boxed{0.98}$

$H_7 = (bias \times w07) + (H_4 \times w47) + (H_5 \times w57) + (H_6 \times w67)$

$= 0 + (0.5 \times 2) + 0 + (0.98 \times 1).$

$= 1.98.$

sigmoid $H_7 = \frac{1}{1+e^{-1.98}} = \boxed{0.87}$

If output neurons are more than 1. To calculate error we will use.

$error\ O_1 = sigmoid\ O_1 (1 - sigmoid\ O_1)(Target\ O_1 - sigmoid\ O_1)$

$error\ O_2 = sigmoid\ O_2 (1 - sigmoid\ O_2)(Target\ O_2 - sigmoid\ O_2)$

$H_8 = (bias \times w_{08}) + (H_4 \times w_{48}) + (H_5 \times w_{58}) + (H_6 \times w_{68})$

$= 0 + 0 + (0.5 \times 1) + 0$

$= 0.5$

$sigmoid\ H_8 = \frac{1}{1+e^{-0.5}} = \boxed{0.62}$

$O_9 = (bias \times w_{09}) + (H_7 \times w_{79}) + (H_8 \times w_{89}$

$= 1 + 0 + (0.62 \times 1)$

$= 1.62$

$sigmoid\ O_9 = \frac{1}{1+e^{-1.62}} = \boxed{0.83}$

→ Calculating errors :-

$error\ O_9 = learning\ rate\ (target_{O_9} - sigmoid\ O_9)^2$

$= 0.5[(1 - 0.83)^2$

$= \boxed{0.014}$

$error\ h_7 = (w_{79} \times error\ O_9)$

$= (0 \times 0.014)$

$= \boxed{0}$

$error\ h_8 = (w_{89} \times error\ O_9)$

$= (1 \times 0.014)$

$= \boxed{0.014}$

$error\ h_4 = (w_{47} \times error\ h_7) + (w_{48} \times error\ h_8)$

$= \boxed{0}$

error h5 = (w57 x error h7) + (w58 x error h8)

= 0 + (1 x 0.014)

= 0.014

error h6 = (w67 x error h7) + (w68 x error h8)

= 0 + 0

= 0

→ Back Propagation :-

Update only weights:

w09, w79, w57.

1) Δw09 = learning rate x error 09 x bias.

= (0.5)(0.014)(1)

= 0.007

w09 (new) = Δw09 + w09 (old)

= 0.007 + 1

= 1.007

2) Δ w79 = learning rate x error 09 x sigmoid h7

= (0.5)(0.014)(0.87)

= 0.00609

w79 (new) = Δw79 + w79 (old)

= 0 + 0.00609 + 0

= 0.00609

3) Δw_{57} = learning rate (error h7)(sigmoid h5)

= 0

$w_{57}(new) = \Delta w_{57} + w_{57}(old)$

= 0 + 0

= 0

4) Δw_{89} = 0.5 (error O_9)(sigmoid H_8)

= (0.5)(0.014)(0.62)

= 0.00434

new(w_{89}) = Δw_{89} + old(w_{89})

= 0.00434 + 1

= 1.00434

5) Δw_{07} = 0.5 (error h7)(bias)

= 0.5(0)(1)

= 0

new(w_{07}) = 0 + 0 = 0

6) Δw_{08} = 0.5 (error h8)(bias)

= 0.5(0.014)(1)

= 0.007

new(w_{08}) = 0.007 + 0

= 0.007

7) Δw_{47} = 0.5 (error h7)(sigmoid H_4)

= 0

new(w_{47}) = 0 + 2

= 2

8) $\Delta w48 = 0.5(\text{error } h8)(\text{sigmoid } h4)$

$= (0.5)(0.014)(0.5)$

$= \boxed{0.0035}$

$\text{new}(w48) = 0.0035 + 0$

$= \boxed{0.0035}$

9) $\Delta w58 = 0.5(\text{error } H8)(\text{sigmoid } H5)$

$= 0.5(0.014)(0.5)$

$= \boxed{0.0035}$

$\text{new}(w58) = \boxed{1.0035}$

10) $\Delta w67 = 0.5(\text{error } H7)(\text{sigmoid } H6)$

$= 0.5(0)$

$= \boxed{0}$

$\text{new}(w67) = \boxed{1}$

11) $\Delta w68 = 0.5(\text{error } H8)(\text{sigmoid } H6)$

$= 0.5(0.014)(0.98)$

$= \boxed{0.00686}$

$\text{new}(w68) = \boxed{0.00686}$

→ Feed Forward :-

sigmoid $H4 = 0.5$

sigmoid $H5 = 0.5$

sigmoid $H6 = 0.98$

$H7 = (\text{bias} \times w07) + (H4 \times w47) + (H5 \times w57) + (H6 \times w67)$

$= 0 + (0.5 \times 2) + (0.5 \times 0) + (0.98 \times 1)$

$= 1 + 0.98$

$= \boxed{1.98}$

$$\text{sigmoid } H_7 = \frac{1}{1+e^{-1.98}}$$

$$= \boxed{0.87}$$

$$h_8 = (\text{bias} \times w_{08}) + (H_4 \times w_{48}) + (H_5 \times w_{58}) + (H_6 \times w_{68})$$

$$= (1 \times 0.007) + (0.5 \times 0.0035) + (0.5 \times 1.0035) + (0.98 \times 0.00686)$$

$$= 0.007 + 0.00175 + 0.50175 + 0.00672$$

$$= 0.5172$$

$$\text{sigmoid } H_8 = \frac{1}{1+e^{-0.5172}}$$

$$= \boxed{0.626}$$

$$O_9 = (\text{bias} \times w_{09}) + (h_7 \times w_{79}) + (h_8 \times w_{89})$$

$$= (1 \times 1.007) + (0.87 \times 0.00609) + (0.626 \times 1.00434)$$

$$= 1.007 + 0.00529 + 0.628$$

$$= 1.6402$$

$$\text{sigmoid } O_9 = \frac{1}{1+e^{-1.6402}}$$

$$= \boxed{0.837}$$

→ Errors:-

Output

$$\text{error } O_9 = 0.5(1 - 0.837)^2$$

$$= 0.5($$

$$= \boxed{0.0132}$$