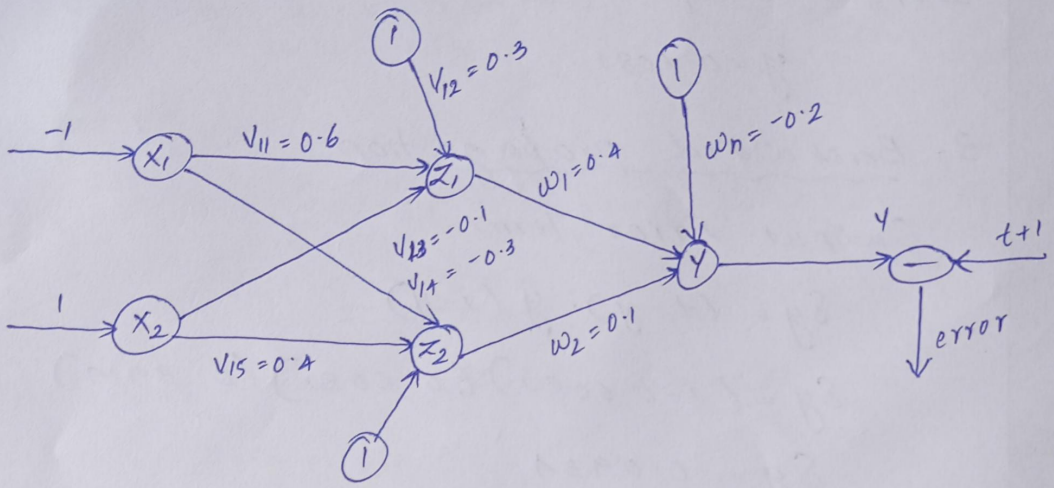
Using the back-propagation network, find the new weights for the network shown in the figure. It is presented with the input pattern [-1, 1] and the target output is 1. Use a learning rate $\alpha = 0.25$ and binary sigmoidal activation function.



1. Initial weights

weight : bias $\rightarrow Z_1 = 0.3$

bias $\rightarrow Z_2 = 0.5$

2. Forward propagation

Hidden layer

For Z_1

$$net_{z_1} = (-1)(0.6) + (1)(-0.1) + (1)(0.3)$$

$$net\ z_1 = -0.6 - 0.1 + 0.3 = -0.4$$

$$z_1 = \sigma(-0.4) = 0.4013$$

For Z_2

$$net\ z_2 = (-1)(-0.4) + (1)(0.4) + (1)(0.5)$$

$$net\ z_2 = 0.4 + 0.4 + 0.5 = 1.3$$

$$z_2 = \sigma(1.3) = 0.7858$$

Output layer

net $y = (0.4013)(0.4) + (0.7858)(0.1) + (1)(0)$

net $y = 0.1605 + 0.0786 + 0.2$

net $y = 0.4391$

Correct output (Before weight output)

$y = 0.6081$

3. Backward propagation

Output Error Term

$\delta y = (t-y) \cdot y(1-y)$

$\delta y = (1-0.6081)(0.6081)(0.3919)$

$\delta y = 0.0934$

4) Update Hidden → output weights.

$\Delta w = \alpha \delta y z$

$w_{21}y$

$\Delta w = 0.25(0.0934)(0.4013)$

$= 0.00937$

$w_{21}y^{new} = \underline{0.4094}$

$w_{22}y$

$\Delta w = 0.25(0.0934)(0.7858) = 0.01836$

$w_{22}y^{new} = \underline{0.1184}$

Bias to y

$\Delta b = 0.25(0.0934) = 0.02335$

by new = $\underline{0.2234}$

5) Hidden Layer Error Terms

$$\delta_z = z(1-z)\,\delta_y\, w$$

for z_1

$$\delta_{z1} = (0.4013)(0.5987)(0.0934)(0.7)$$

$$\delta_{z1} = \underline{0.00898}$$

for z_2

$$\delta_{z2} = (0.7858)(0.2142)(0.0934)(0.1)$$

$$\delta_{z2} = \underline{0.001572}$$

6) Update Input → Hidden weights.

$$\Delta v = a\,\delta_z\, x$$

Updated weights for z_1

Weight	New Value
V_{x1z1}	0.5978
V_{x2z1}	−0.0978
Bias z_1	0.3023

Updated weights for z_2

Weight	New Value
V_{x1z2}	−0.40039
V_{x2z2}	0.40039
Bias z_2	0.50039

7) Network output

$$y = 0.6081$$

2) Updated weights

Hidden → output

- $w_{z1y} = 0.4094$
- $w_{z2y} = 0.1184$
- $b_y = 0.2234$

Input → Hidden

$V_{x1z1} = 0.5978$

$V_{x2z1} = -0.0978$

$b_{z1} = 0.3023$

$V_{x1z2} = -0.40039$

$V_{x2z2} = 0.40039$

$b_{z2} = 0.50039$