Assume that $\eta = 1$.

and $E(w) = \sum_{d \in D} -y^{(d)} \ln(O^{(d)}) - (1-y^{(d)}) \ln(1-O^{(d)})$

~~loss~~ function.

$O(v) = \dfrac{1}{1+e^{-v}}$ - objective function,

where $v^j = \sum_{i=1}^{u_j} w_i^j \cdot O_{j-1} + w_0^j$

① Output layer:

$$\delta_1 = -\frac{\partial E}{\partial v} = -\frac{\partial E}{\partial O} \cdot \frac{\partial O}{\partial v} = -\frac{O-y}{\cancel{O(1-O)}} \cancel{O(1-O)}$$

$$= y - O$$

② Hidden layer

$$\delta_j = -\frac{\partial E}{\partial u_j} = -\frac{\partial E}{\partial v} \cdot \frac{\partial v}{\partial h_j} \cdot \frac{\partial h_j}{\partial u_j} =$$

$$= (y-O) \cdot w_{h_j} \cdot h_j (1-h_j) =$$

$$= h_j (1-h_j) \cdot \delta_1 \cdot w_{h_j}, \quad j \in \{1, 2, 3.\}$$

③ Δw.

1) Output.

$$\Delta w = (y-O) \cdot h_j$$

2) Hidden:

$$\Delta w_{ji} = h_j (1-h_j)(y-O)\, w_{h_j} \cdot x_i$$

(4) 1) Forward:

- $o = 0.997657.$
- $h_1 = 0.99987$
- $h_2 = 0.9999$
- $h_3 = 0.04750$

2) output:

$\delta = 0.00235923555$

hidden:

$\delta_1 = 8.732\ e{-07}$

$\delta_2 = 1.9534 e{-10}$

$\delta_3 = 0.000106$

3) hidden:

$\Delta w_0 = 0.00235$

$\Delta w_1 = 0.00235$

$\Delta w_2 = 0.00235$

$\Delta w_3 = 0.00011$

Input:

$\Delta w_0 = (8.73e-07, 1.95e-10, 0.000106)$

$\Delta w_1 = (8.73e-07, 1.95e-10, 0.000106)$

$\Delta w_2 = (2.61e-06, 5.86e-10, 0.0003)$

$\Delta w_3 = (1.74e-06, 3.906e-10, 0.0002)$

$\Delta w_4 = (8.73e-07, 1.953e-10, 0.00106)$