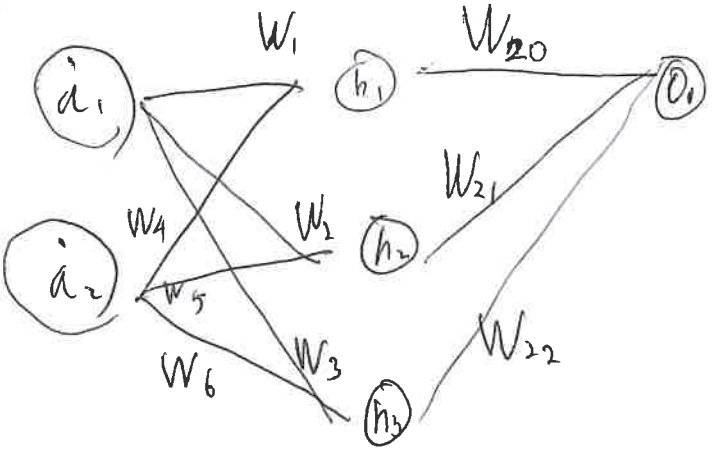
Notation



$net\,h_1 = a_1 W_1 + a_2 W_4 + b_1$

$net\,h_2 = a_1 W_2 + a_2 W_5 + b_1$

$net\,h_3 = a_1 W_3 + a_2 W_6 + b_1$

$Out\,h_1 = sigmoid(net\,h_1)$

$Out\,h_2 = sigmoid(net\,h_2)$

$Out\,h_3 = sigmoid(net\,h_3)$

$$net\,O_1 = Out\,h_1 W_{20} + Out\,h_2 W_{21} + Out\,h_3 W_{22} + b_2$$

$$Out\,O_1 = sigmoid(net\,O_1)$$

---

① W_{20} 미분값구하기 (python delta_W2[0][0])

$$\frac{\partial Loss}{\partial W_{20}} = \frac{\partial Loss}{\partial y} \times \frac{\partial y}{\partial net O_1} \times \frac{\partial net O_1}{\partial W_{20}} = \frac{-y-t}{y(1-y)} \times y(1-y) \times Out\,h_1$$

$$= Out\,h_1 \times (-y-t)$$

$$\frac{\partial Loss}{\partial W_{21}} = Oh_2(-y-t)$$

$$\frac{\partial Loss}{\partial W_{22}} = Out\,h_3(-y-t)$$

python

sigmoid(zin[0][0] × W1[0][0] + zin[0][1] × W1[1][0] + b1[0][0]) × −1 × (−z2[0] + ans)

② W_1 미분하기 (python delta_W1[0][0])

$$\frac{\partial Loss}{\partial W_1} = \frac{\partial Loss}{\partial y} \times \frac{\partial y}{\partial neto_1} \times \frac{\partial neto_1}{\partial outh_1} \times \frac{\partial outh_1}{\partial neth_1} \times \frac{\partial neth_1}{\partial W_1}$$

$$\frac{-y-t}{y(1-y)} \times y(1-y) \times W_{20} \times Sigmoid(neth_1)(1-Sigmoid(neth_1)) \times \grave{a}_1$$

$$= (-y-t) \times W_{20} \times S(neth_1)(1-S(neth_1)) \times \grave{a}_1$$

⇒ python (delta_W1[0][0]) ⇒ $-1 \times (z2[0]+ans) \times W2[0][0] \times z[0] \times (1-z2[0]) \times x_{2m}[0][0]$

---

③ b_2 미분하기

$$\frac{\partial Loss}{\partial b_2} = \frac{\partial Loss}{\partial y} \times \frac{\partial y}{\partial neto_1} \times \frac{\partial neto_1}{\partial b_2} = \frac{-y-t}{(1-y)y} \times (1-y)y \times 1$$

⇒ python

$-1 \times (z2[0]+ans)$ [illegible]

④ b_1 미분하기

$$\frac{\partial Loss}{\partial b_1} = \frac{\partial Loss}{\partial y} \times \frac{\partial y}{\partial neto_1} \times \frac{\partial neto_1}{\partial outh_1} \times \frac{\partial outh_1}{\partial neth_1} \times \frac{\partial neth_1}{\partial b_1}$$

$$= \frac{-y-t}{(1-y)y} \times (1-y)(y) \times neth_1 \times Sigmoid(neth_1) \times W_{20} \times 1$$

python

⇒ $-1 \times (z2[0]+ans) \times W_2[0][0] \times [zm[0][0] \times W_1[0][0] + zm[0][1] \times W_1[0][1] + b_1[0][0]] \times z[0]$