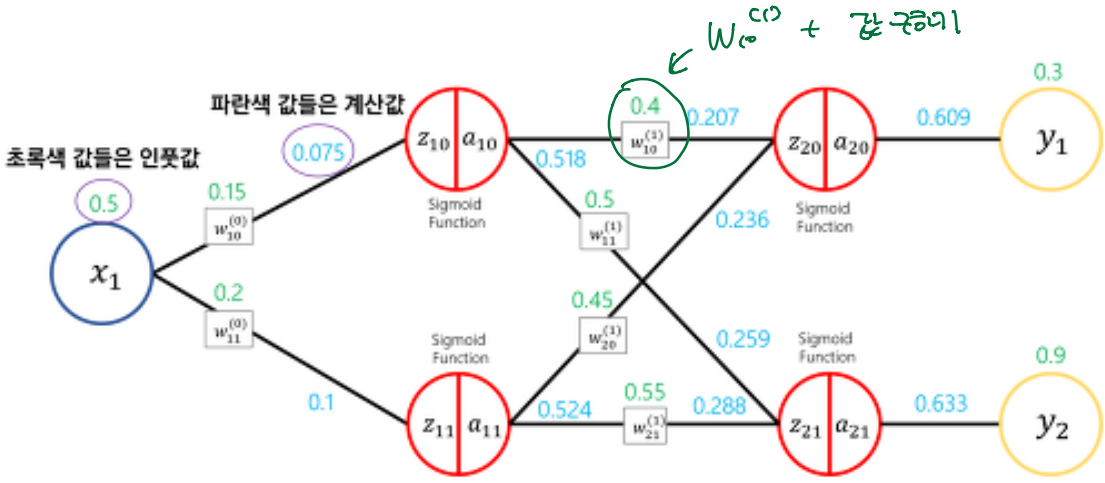


$$\frac{\partial E_{tot}}{\partial w_{10}^{(1)}} = \textcircled{1}\frac{\partial E_{tot}}{\partial a_{20}} \cdot \textcircled{2}\frac{\partial a_{20}}{\partial z_{20}} \cdot \textcircled{3}\frac{\partial z_{20}}{\partial w_{10}^{(1)}}$$

①

$$E_{tot} = \frac{1}{2}\left((target_{Y_1} - a_{20})^2 + (target_{Y_2} - a_{21})^2\right)$$

↓

$$\frac{1}{2}\left(target_{Y_1}^2 - 2a_{20} \cdot target_{Y_1} + a_{20}^2\right)$$

$$\frac{1}{2}target_{Y_1}^2 - a_{20} \cdot target_{Y_1} + \frac{1}{2}a_{20}^2$$

$$\frac{\partial E_{tot}}{\partial a_{20}} = -target_{Y_1} + a_{20}$$

②

$$a_{20} = \text{Sigmoid}(z_{20})$$

$$\frac{\partial a_{20}}{\partial z_{20}} = \text{Sigmoid}(z_{20}) \cdot (1 - \text{Sigmoid}(z_{20}))$$

$$F(x) = \frac{1}{1+e^{-x}} \quad \leftarrow f(x),\ g(x)$$

몫의 법칙

$$F'(x) = \frac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{g^2(x)}$$

$$F'(x) = \frac{0 - 1 \times -e^{-x}}{(1+e^{-x})^2} = \frac{e^{-x}}{(1+e^{-x})^2}$$

$$= \frac{1+e^{-x}-1}{(1+e^{-x})^2} = \frac{1}{1+e^{-x}} - \frac{1}{(1+e^{-x})^2} = \frac{1}{1+e^{-x}}\left(1 - \frac{1}{1+e^{-x}}\right)$$

$$F(x) \times (1 - F(x))$$

③

$$z_{20} = w_{10}^{(1)} \cdot a_{10} + w_{20}^{(1)} \cdot a_{11}$$

$$\frac{\partial z_{20}}{\partial w_{10}} = a_{10} + 0$$

편미계산

$$\frac{\partial E_{tot}}{\partial w_{10}^{(1)}} = \frac{\partial E_{tot}}{\partial a_{20}} \times \frac{\partial a_{20}}{\partial z_{20}} \times \frac{\partial z_{20}}{\partial w_{10}^{(1)}}$$

$$= (a_{20} - target\, y_1) \times sigmoid(z_{20}) \times (1 - sigmoid(z_{20})) \times a_{10}$$

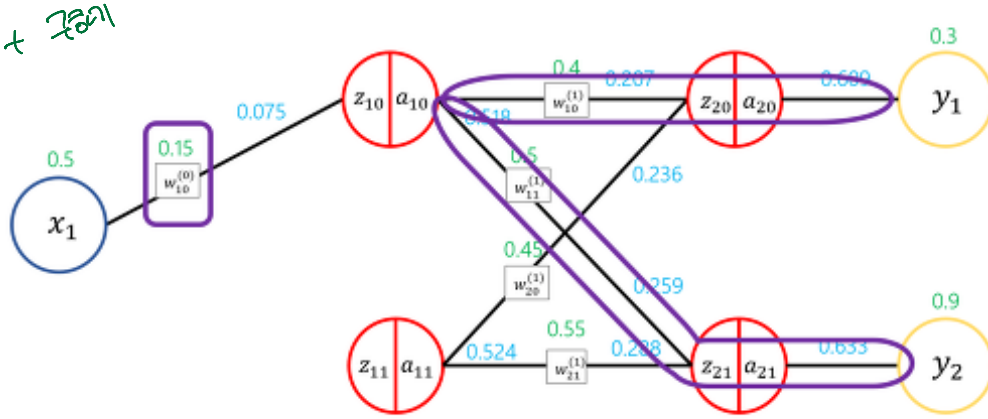
$$= (0.609 - 0.3) \times 0.609 \times (1 - 0.609) \times 0.516$$

$$= 0.0381$$

$$w_{10}^{(1)+} = w - \eta * \frac{\partial E_{tot}}{\partial w_{10}^{(1)}} = 0.4 - 0.5 \times 0.0381$$

$$= \underline{0.381}$$

$w_{10}^{(0)+}$ 구하기



$$\frac{\partial E_{tot}}{\partial w_{10}^{(0)}} = \frac{\partial E_{tot}}{\partial a_{10}} \frac{\partial a_{10}}{\partial z_{10}} \frac{\partial z_{10}}{\partial w_{10}^{(0)}} \qquad E_{tot} = E_{y1} + E_{y2}$$

↳ 이거는 두 곳에서 영향 받기
때문에 아래와 같이

연산 되어야 한다.

$$\frac{\partial (E_{y_1}+E_{y_2})}{\partial a_{10}} \times \frac{\partial a_{10}}{\partial z_{10}} \times \frac{\partial z_{10}}{\partial w_{10}^{(0)}}$$

$$= \left(\frac{\partial E_{y_1}}{\partial a_{10}} + \frac{\partial E_2}{\partial a_{10}} \right) \times \frac{\partial a_{10}}{\partial z_{10}} \times \frac{\partial z_{10}}{\partial w_{10}^{(0)}}$$

이 부분은 위와 동일

$$\frac{\partial E_2}{\partial a_{10}} = \frac{\partial E_2}{\partial a_{21}} \times \frac{\partial a_{21}}{\partial z_{21}} \times \frac{\partial z_{21}}{\partial a_{10}}$$

$$= -(\text{target}_{y_2} - a_{21}) * \text{sigmoid}(z_{21}) * (1 - \text{sigmoid}(z_{21})) * w_{11}^{(1)}$$

$$= -(0.9 - 0.633) * 0.633 * 0.5$$

$$= -0.0326$$

가장 상단의 원리만 이해하면

나머지는 동일한 원리로 해결가능!!!