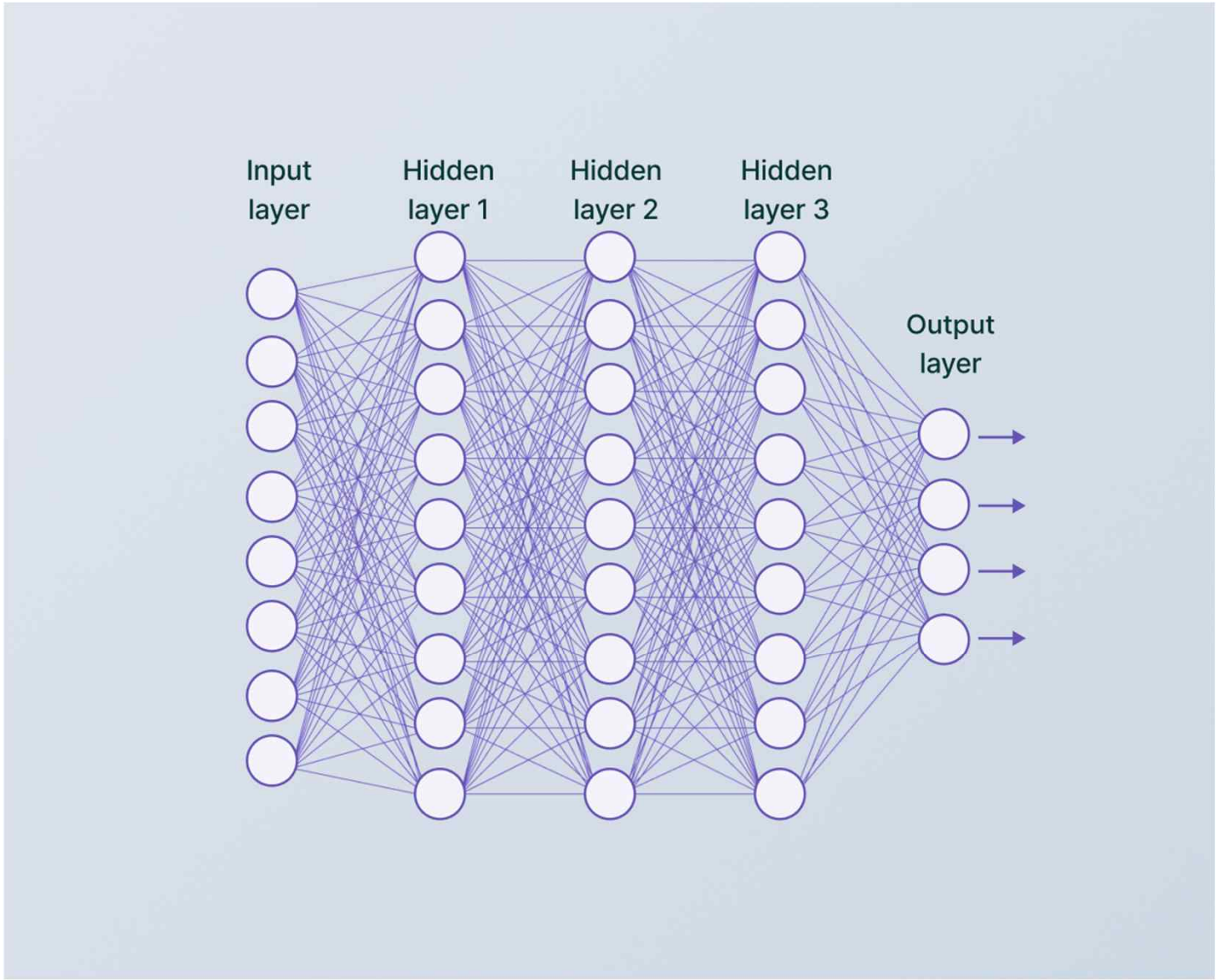
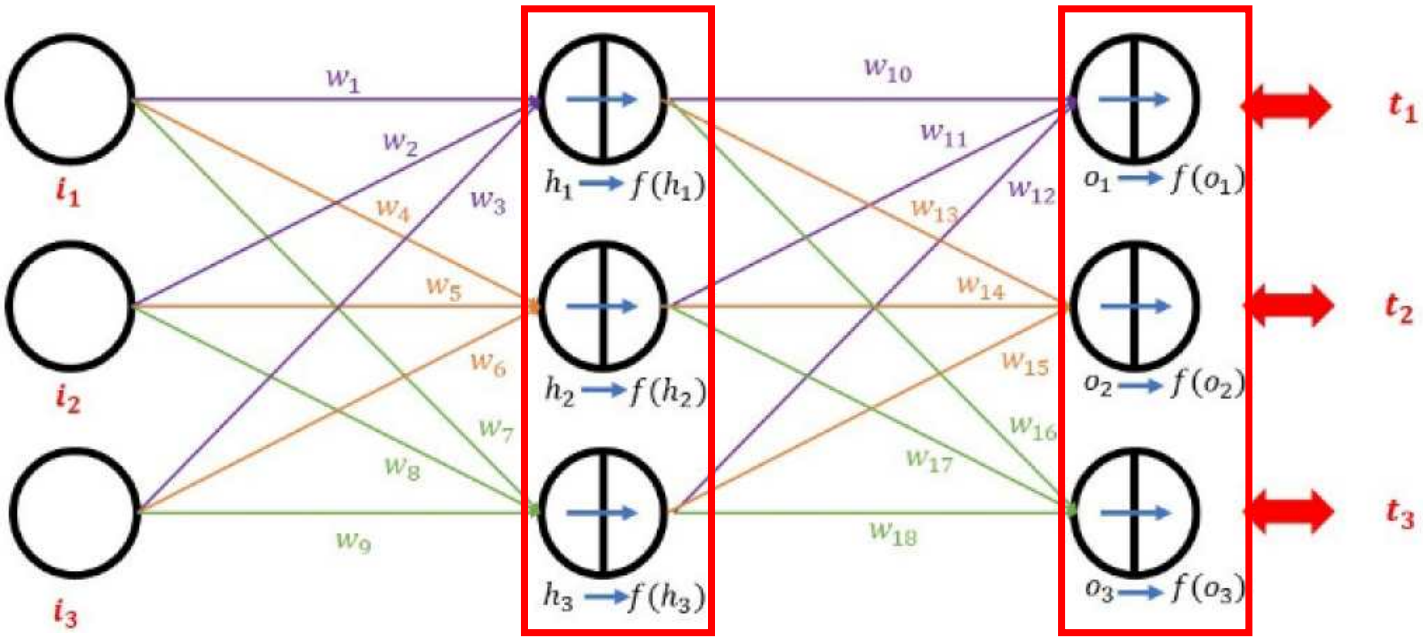
2024년 6월 11일

- 모임 일정
  - 매월 격주
    - ~~1/3주, 화 오후 1시 30분~~
    - **2/4주, 화 오후 2시 30분**

- 목표
  - 최소 2가지 이상
    - 레이저 이용 말벌 퇴치 (진딧물 등 해충 퇴치)
    - ???

- 목표에 따라 팀 구성
  - 격주로 번갈아 가며 토론 준비


Input layer
Hidden layer 1
Hidden layer 2
Hidden layer 3
Output layer

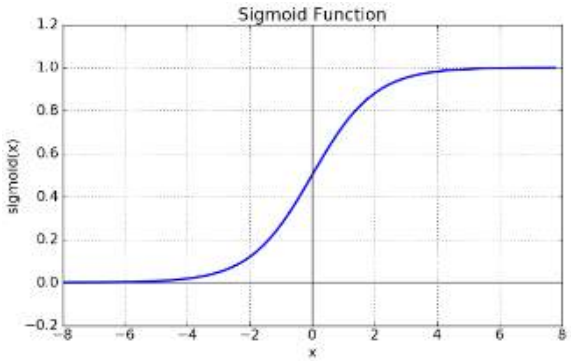


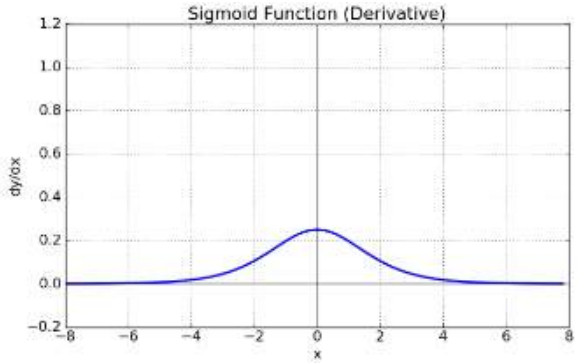
활성화함수
(Activation Function)

활성화함수
(Activation Function)

Sigmoid

$$sigmoid(x) = \frac{1}{1 + e^{-x}}$$

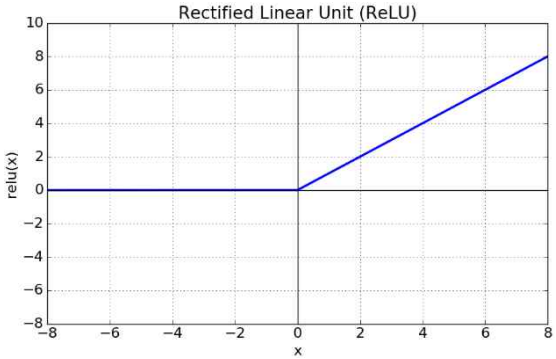




sigmoid 미분

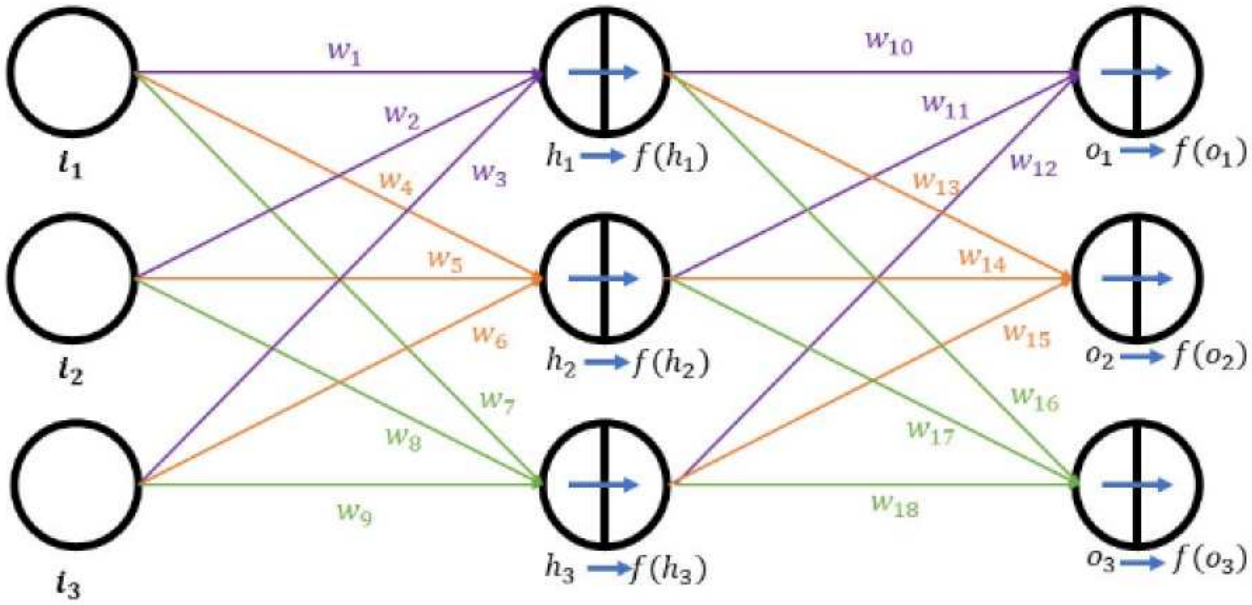
ReLU (Rectified Linear Unit, 경사함수)

$$f(x) = max(0, x)$$



Leaky ReLU (Rectified Linear Unit, 경사함수)

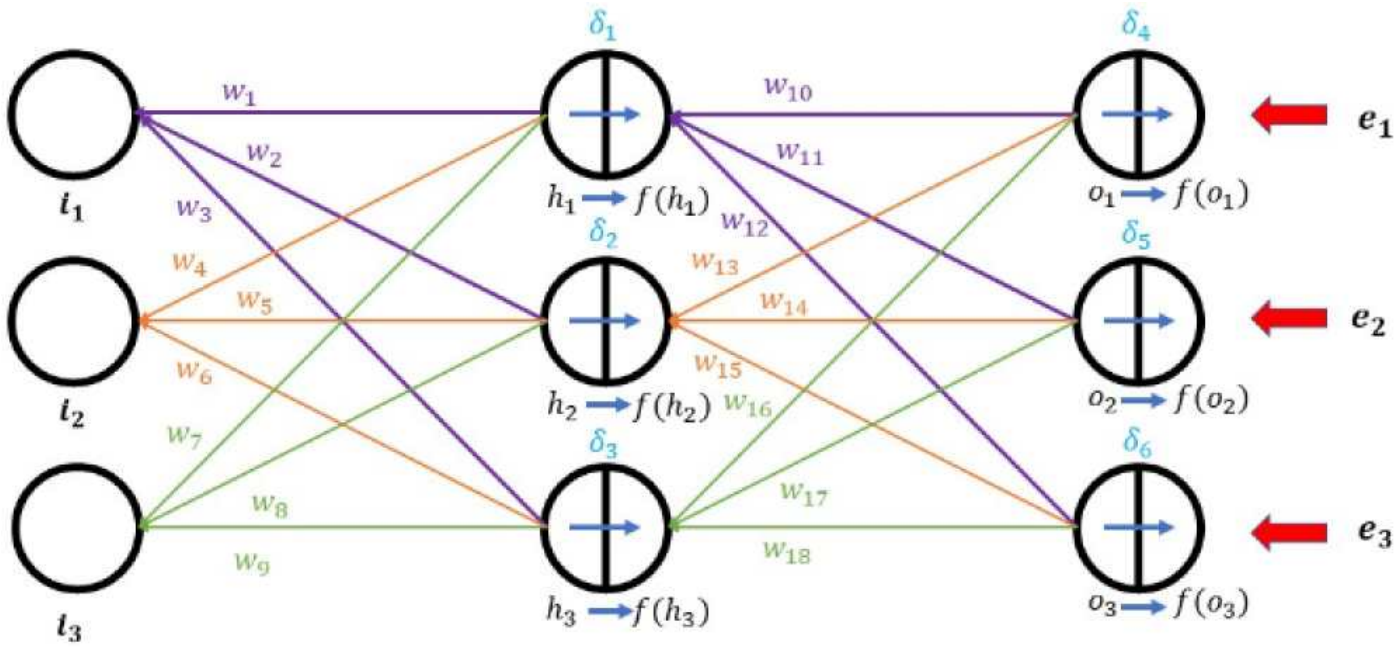
$$f(x) = max(0.01x, x)$$



$$h_1 = w_1 * i_1 + w_2 * i_2 + w_3 * i_3$$
$$h_2 = w_4 * i_1 + w_5 * i_2 + w_6 * i_3$$
$$h_3 = w_7 * i_1 + w_8 * i_2 + w_9 * i_3$$

$$o_1 = w_{10} * f(h_1) + w_{11} * f(h_2) + w_{12} * f(h_3)$$
$$o_2 = w_{13} * f(h_1) + w_{14} * f(h_2) + w_{15} * f(h_3)$$
$$o_3 = w_{16} * f(h_1) + w_{17} * f(h_2) + w_{18} * f(h_3)$$

오차 역전파(Back Propagation, BP)

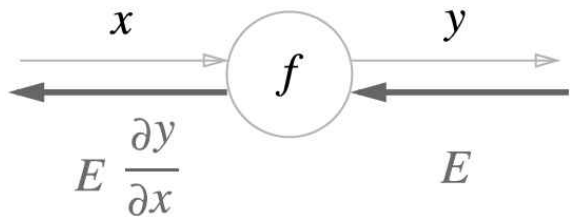


$$\delta_1 = (w_{10} * \delta_4 + w_{11} * \delta_5 + w_{12} * \delta_6) * f'(h_1) \qquad \delta_4 = e_1 * f'(o_1)$$

$$\delta_2 = (w_{13} * \delta_4 + w_{14} * \delta_5 + w_{15} * \delta_6) * f'(h_2) \qquad \delta_5 = e_2 * f'(o_2)$$

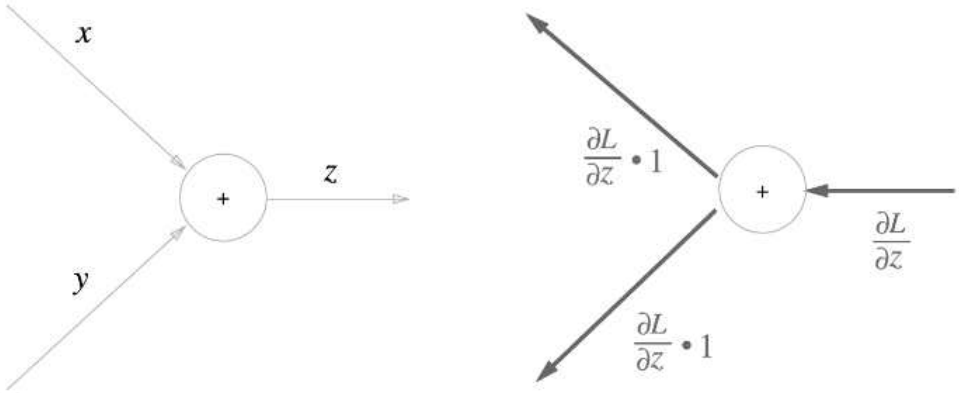
$$\delta_3 = (w_{16} * \delta_4 + w_{17} * \delta_5 + w_{18} * \delta_6) * f'(h_3) \qquad \delta_6 = e_3 * f'(o_3)$$

미분 연쇄법칙(Chain Rule)



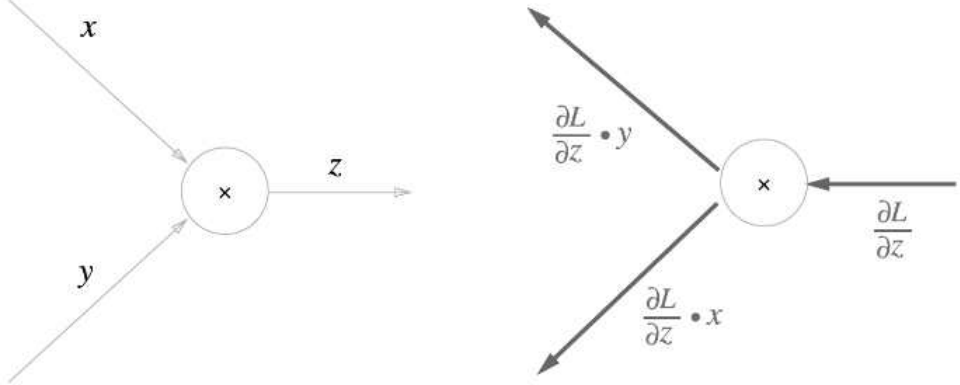
덧셈노드 (z = x + y)

$$\frac{\partial z}{\partial x} = 1$$
$$\frac{\partial z}{\partial y} = 1$$



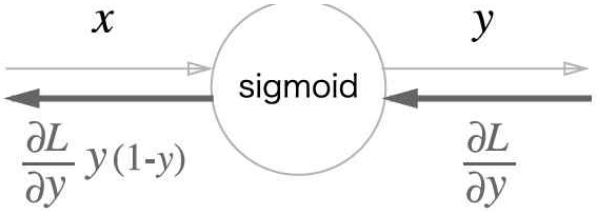
곱셈노드 (z = xy)

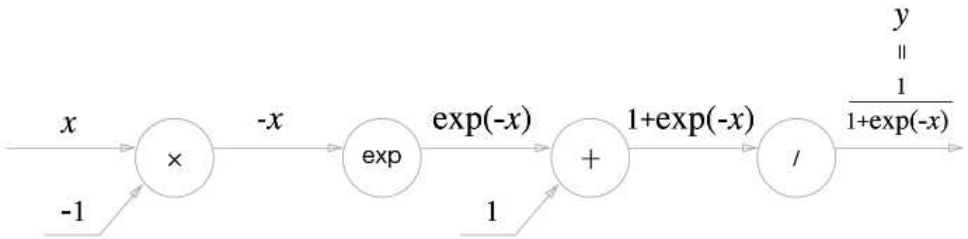
$$\frac{\partial z}{\partial x} = y$$
$$\frac{\partial z}{\partial y} = x$$

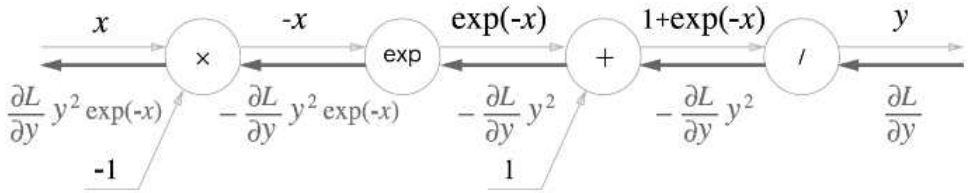


sigmoid 미분

$$y = \frac{1}{1 + e^{-x}}$$



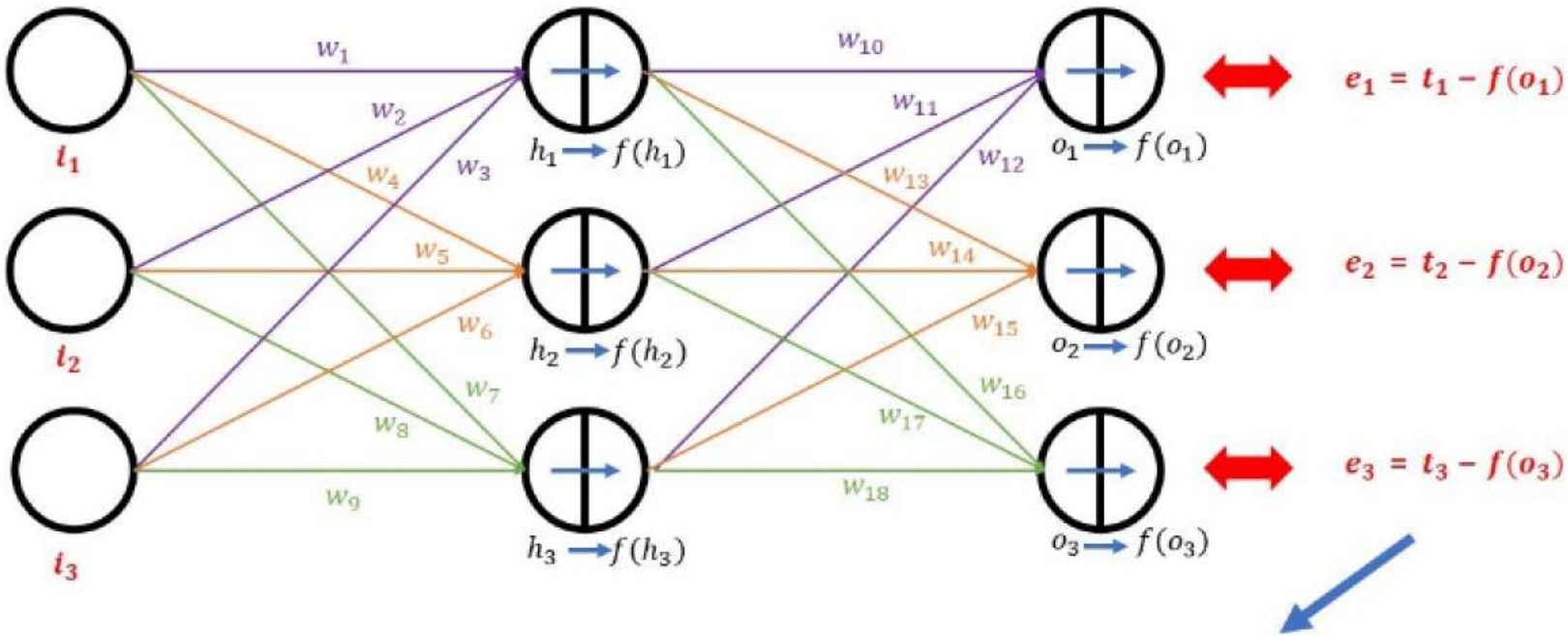




relu 미분

$$\frac{\partial y}{\partial x} = \begin{cases} 1 & (x > 0) \\ 0 & (x \leq 0) \end{cases}$$

평균제곱에러(Mean Square Error, MSE)



$$E_{total} = \frac{1}{2}\{(t1 - f(o1)\}^2 + \frac{1}{2}\{(t2 - f(o2)\}^2 + \frac{1}{2}\{(t3 - f(o3)\}^2 = \frac{1}{2}e_1{}^2 + \frac{1}{2}e_2{}^2 + \frac{1}{2}e_3{}^2$$

$$\frac{\partial E_{total}}{\partial w10} = \frac{\partial E_{total}}{\partial f(o1)} * \frac{\partial f(o1)}{\partial o1} * \frac{\partial o1}{\partial w10}$$

$$\frac{\partial E_{total}}{\partial f(o1)} = -\big(t1 - f(o1)\big) = -e1$$

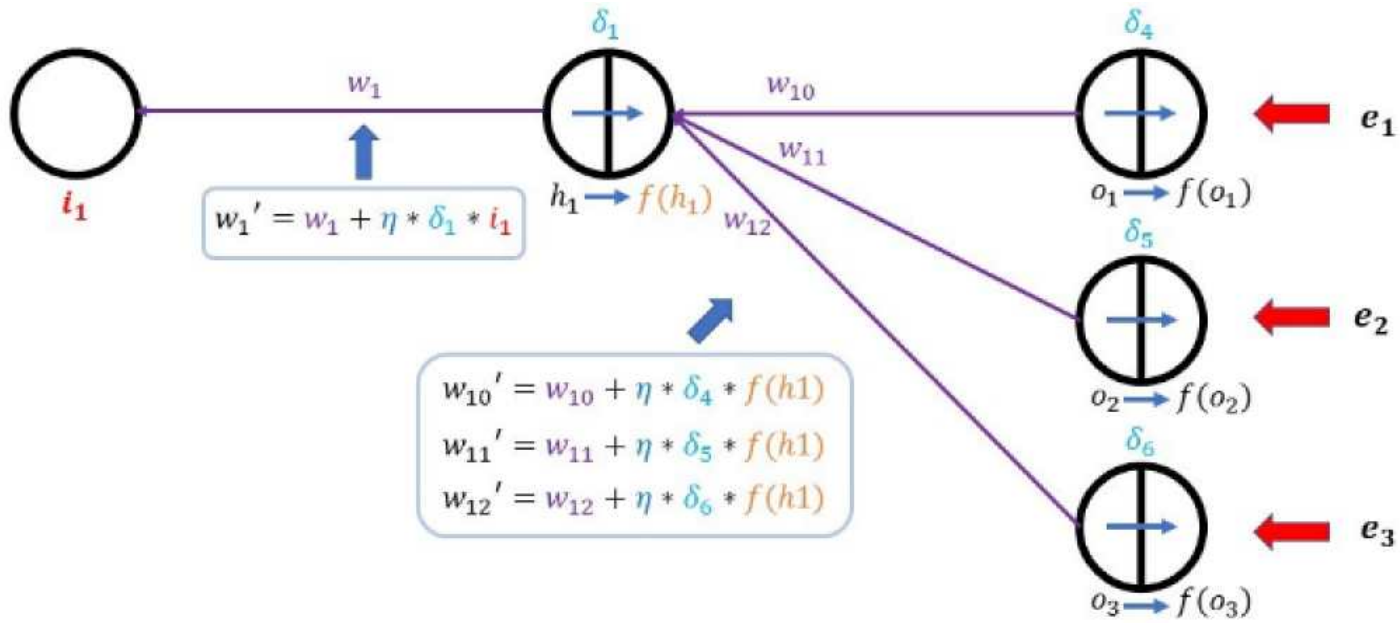
$$\frac{\partial f(o1)}{\partial o1} = f'(o1) = f(o1) * \{1 - f(o1)\}$$

$$\frac{\partial o1}{\partial w10} = f(h1)$$

$$w_{10}{}' = w_{10} - \eta \frac{\partial E_{total}}{\partial w10} = w_{10} + \eta * e1 * f'(o1)^* \ f(h1)$$

$$= w_{10} + \eta * \delta_{w10} * f(h1)$$

η : 학습률



$$\delta_1 = (w_{10} * \delta_4 + w_{11} * \delta_5 + w_{12} * \delta_6) * f'(h_1) \qquad \delta_4 = e_1 * f'(o_1)$$

$$\delta_2 = (w_{13} * \delta_4 + w_{14} * \delta_5 + w_{15} * \delta_6) * f'(h_2) \qquad \delta_5 = e_2 * f'(o_2)$$

$$\delta_3 = (w_{16} * \delta_4 + w_{17} * \delta_5 + w_{18} * \delta_6) * f'(h_3) \qquad \delta_6 = e_3 * f'(o_3)$$

$$\frac{\partial E_{total}}{\partial w1} = \frac{\partial E_{total}}{\partial f(h1)} * \frac{\partial f(h1)}{\partial h1} * \frac{\partial h1}{\partial w1}$$

$$\frac{\partial E_{total}}{\partial f(h1)} = \frac{\partial E_1}{\partial f(h1)} + \frac{\partial E_2}{\partial f(h1)} + \frac{\partial E_3}{\partial f(h1)}$$

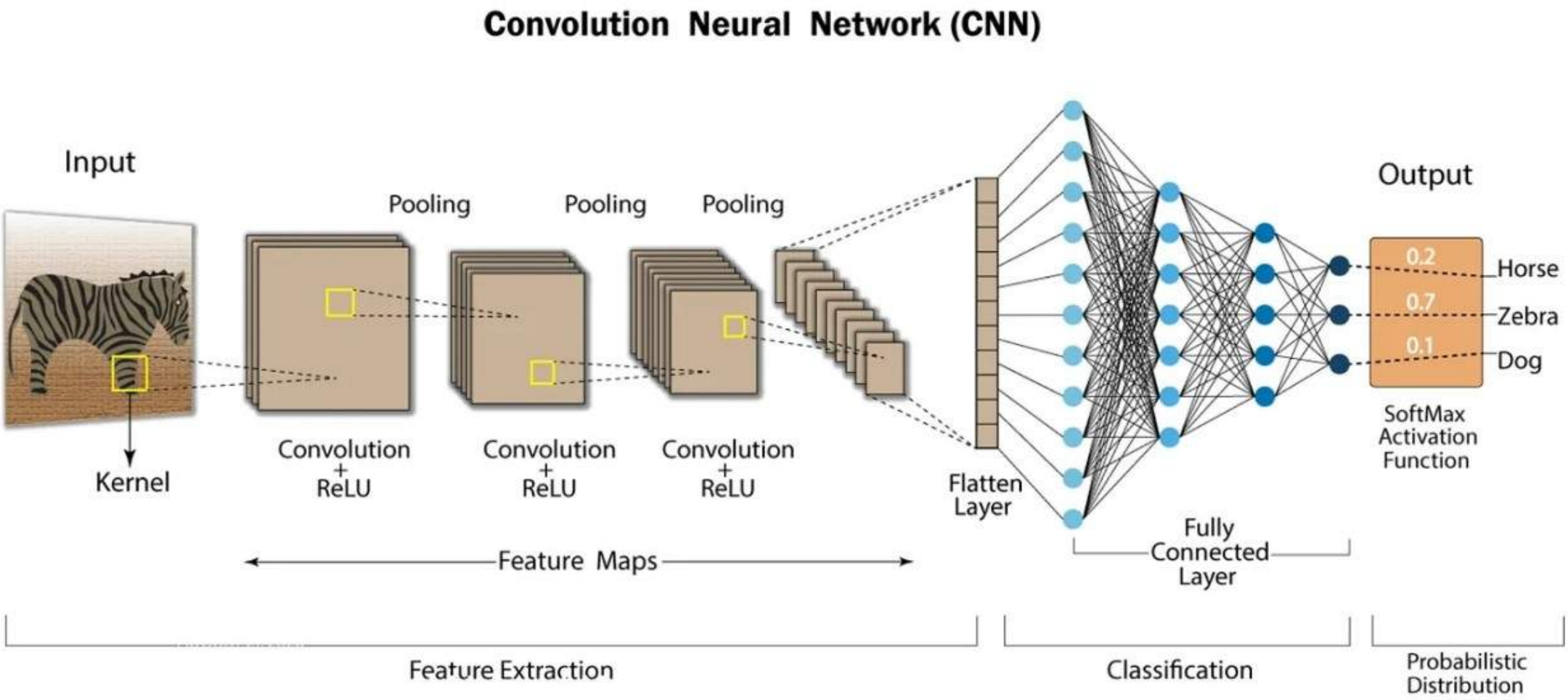
$$\frac{\partial E_1}{\partial f(h1)} = \frac{\partial E_1}{\partial f(o1)} * \frac{\partial f(o1)}{\partial o1} * \frac{\partial o1}{\partial f(h1)} = -e_1 * f'(o_1) * w_{10} = -\delta_{w10} * w_{10}$$

$$\frac{\partial f(h1)}{\partial h1} = f'(h1) = f(h1) * \{1 - f(h1)\}$$

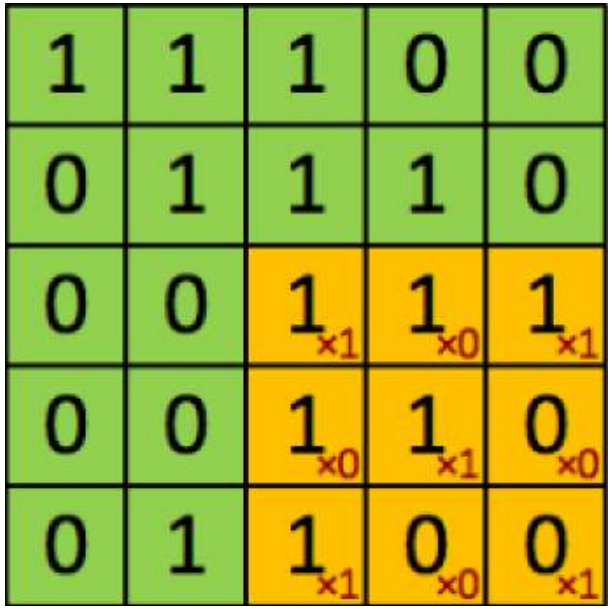
$$\frac{\partial h1}{\partial w1} = i1$$

$$w_1' = w_1 - \eta \frac{\partial E_{total}}{\partial w_1} = w_{10} + \eta * \{e_1 * f'(o_1) * w_{10} + e_2 * f'(o_2) * w_{11} + e_3 * f'(o_3) * w_{12}\} * f'(h_1) * i_1$$

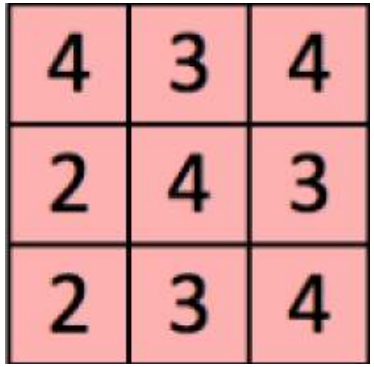
$$= w_1 + \eta * \delta_{w1} * i_1$$


Convolution Neural Network (CNN)
Input
Pooling
Pooling
Pooling
Output
0.2
Horse
0.7
Zebra
0.1
Dog
Kernel
Convolution + ReLU
Convolution + ReLU
Convolution + ReLU
Flatten Layer
SoftMax Activation Function
Feature Maps
Fully Connected Layer
Feature Extraction
Classification
Probabilistic Distribution

Convolution Integration



이미지 (5x5)



커널 (3x3)