

homework #9



$$\frac{\partial E}{\partial w_1} = \frac{\partial E}{\partial y} \cdot \left(\frac{\partial y}{\partial net_2} \cdot \frac{\partial net_2}{\partial h} \cdot \frac{\partial h}{\partial net_1} \cdot \frac{\partial net_1}{\partial w_1} + \frac{\partial y}{\partial h} \cdot \frac{\partial h}{\partial net_1} \cdot \frac{\partial net_1}{\partial w_1} \right)$$

$$= \frac{\partial E}{\partial y} \cdot \frac{\partial h}{\partial net_1} \cdot \frac{\partial net_1}{\partial w_1} \cdot \left(\frac{\partial y}{\partial net_2} \cdot \frac{\partial net_2}{\partial h} + \frac{\partial y}{\partial h} \right)$$

$$net_1 = x \cdot w_1$$

$$h = ReLU(net_1) + x$$

$$net_2 = h \cdot w_2$$

$$y = ReLU(net_2) + h$$

$$E = \frac{1}{2}(t - y)^2$$

① $net_1 > 0, net_2 > 0$

$$\frac{\partial E}{\partial w_1} = (y - t) (1 \cdot w_2 \cdot 1 \cdot x + 1 \cdot 1 \cdot x) = (y - t)(w_2 \cdot x + x) = (y - t)x(w_2 + 1)$$

② $net_1 > 0, net_2 < 0$

$$\frac{\partial E}{\partial w_1} = (y - t) (0 \cdot w_2 \cdot 1 \cdot x + 1 \cdot 1 \cdot x) = (y - t)x$$

③ $net_1 < 0, net_2 > 0$

$$\frac{\partial E}{\partial w_1} = (y - t) (1 \cdot w_2 \cdot 0 \cdot x + 1 \cdot 0 \cdot x) = 0$$

④ $net_1 < 0, net_2 < 0$

$$\frac{\partial E}{\partial w_1} = (y - t) (0 \cdot w_2 \cdot 0 \cdot x + 1 \cdot 0 \cdot x) = 0$$

2. $x_1 = 1$

$$h_1 = y(0.5 \times 1 + (-1) \times 1)$$

$$= y(-0.5) = -1$$

$$x_2 = -1$$

$$h_2 = y(0.5 \times (-1) + (-1) \times (-1))$$

$$= y(0.5) = 1$$

$$x_3 = -1$$

$$h_3 = y(0.5 \times 1 + (-1) \times (-1))$$

$$= y(1.5) = 1$$

$$x_4 = 1$$

$$h_4 = y(0.5 \times 1 + (-1) \times 1) = y(-0.5) = -1$$

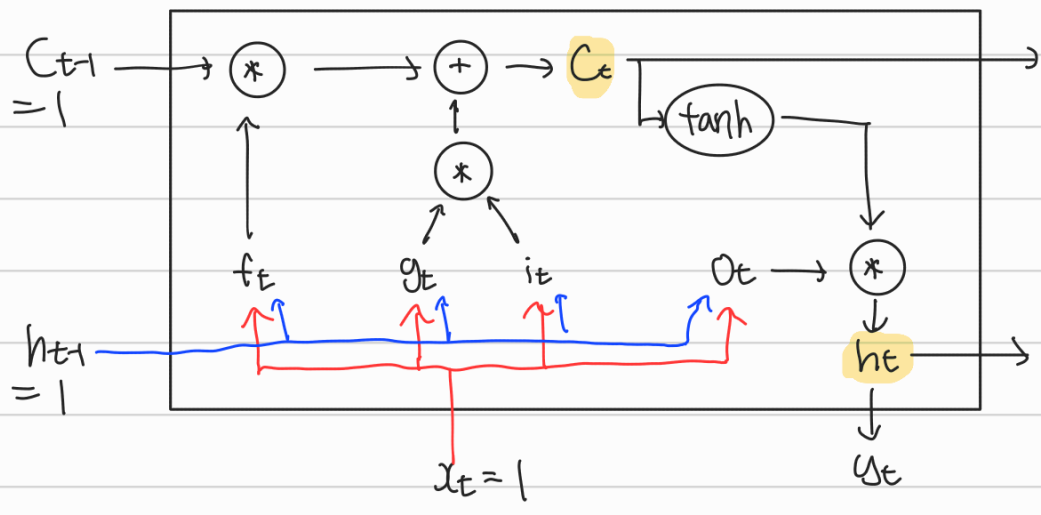
$$\therefore h_1 = -1$$

$$h_2 = 1$$

$$h_3 = 1$$

$$h_4 = -1$$

3.



$$i_t = \text{sigmoid}(0) = 0.5, \quad f_t = \text{sigmoid}(0) = 0.5, \quad O_t = \text{sigmoid}(0) = 0.5$$

$$g_t = \tanh(0) = 0$$

$$C_t = C_{t-1} \times f_t + g_t \times i_t = 1 \times 0.5 + 0 \times 0.5 = 0.5$$

$$h_t = \tanh(C_t) \times O_t = 0.231$$

$$\therefore C_t = 0.5$$

$$h_t = 0.231$$