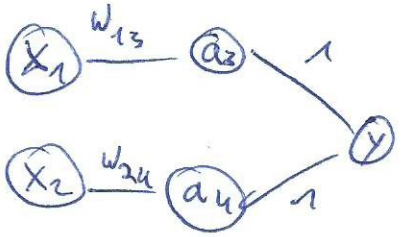
Sheet 07

① a)



b) $$\frac{\partial L}{\partial w_{13}} = \frac{\partial L}{\partial y} \cdot \frac{\partial y}{\partial a_3} \cdot \frac{\partial a_3}{\partial z_3} \cdot \frac{\partial z_3}{\partial w_{13}} = (y-1) \cdot 1 \cdot z_3 \cdot x_1$$

c) $$\frac{\partial L}{\partial v} = \frac{\partial w_{13}}{\partial v} \cdot \frac{\partial L}{\partial w_{13}} + \frac{\partial w_{24}}{\partial v} \cdot \frac{\partial L}{\partial w_{24}}$$

② a) $$\left[\frac{\partial f}{\partial w^{(k,l)}}\right]_u = \sum_{t=-\infty}^{\infty} \underbrace{\frac{\partial f}{\partial a_t^{(l)}} \cdot 1_{z_t^{(l)}>0}}_{\delta_t^{(l)}} \cdot \frac{\partial z_t^{(l)}}{\partial w_u^{(k,l)}}$$

$$= \sum_{t=-\infty}^{\infty} \delta_t^{(l)} \cdot \frac{\partial}{\partial w_u^{(k,l)}} \sum_{s=-\infty}^{\infty} x_s^{(k)} w_{t-s}^{(k,l)}$$

$$= \sum_{t=-\infty}^{\infty} \delta_t^{(l)} \cdot x_{t-u}^{(k)}$$

$$\boxed{\begin{aligned} t^* &= t-u \\ t &= t^*+u \end{aligned}}$$

$$= \sum_{t^*=-\infty}^{\infty} \delta_{t^*+u}^{(l)} \cdot x_{t^*}^{(k)} = \left[x^{(k)} * \delta^{(l)}\right]_u$$

cross correlation of x and δ