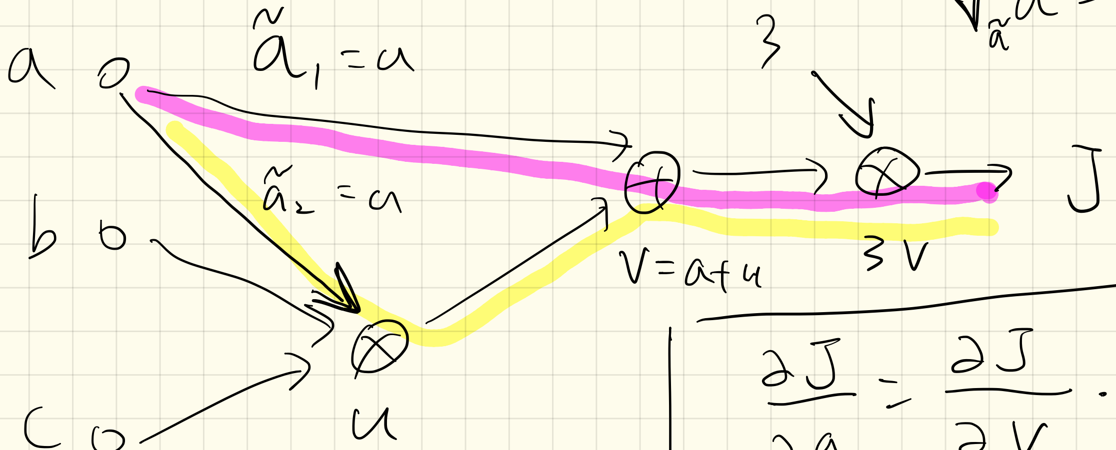
$\circ \quad J = 3(a + abc)$

$a = \tilde{a}_1 = \tilde{a}_2$

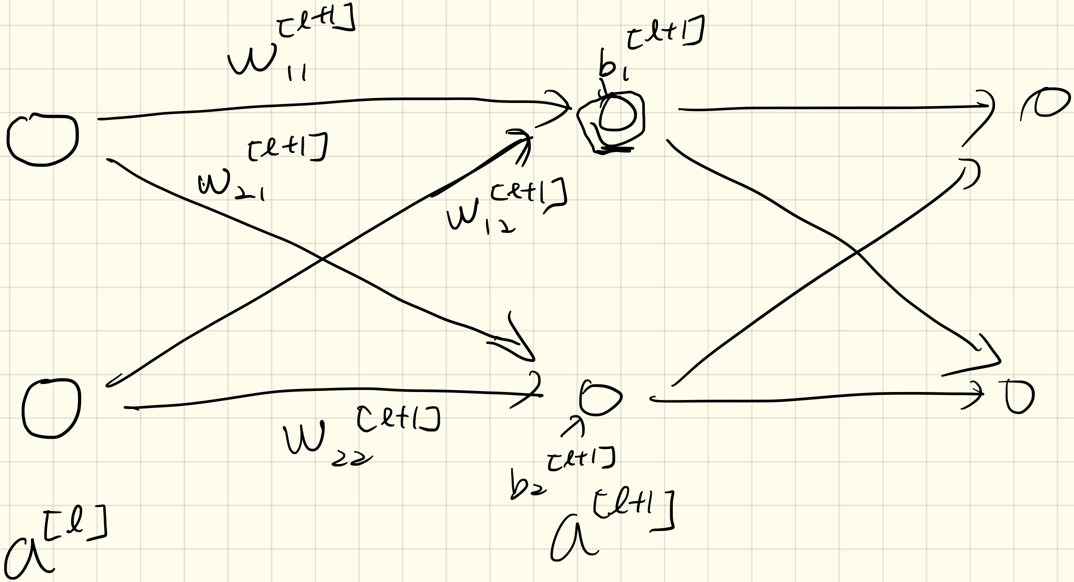
$\nabla_{\tilde{a}} a = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$



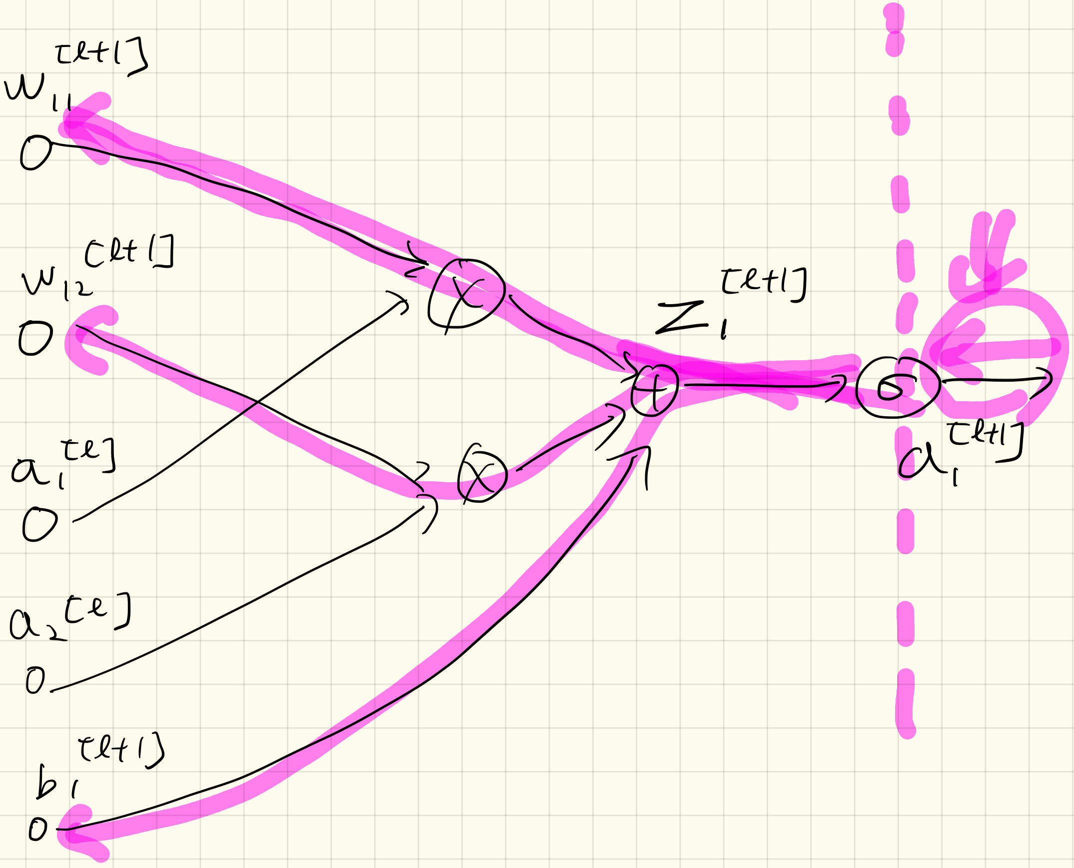
$$\boxed{\frac{\partial J}{\partial a} = \underbrace{\frac{\partial J}{\partial V}}_{=3} \cdot \underbrace{\frac{\partial V}{\partial a}}_{=1}}$$

$$\frac{\partial J}{\partial a} = \boxed{\frac{\partial J}{\partial V} \cdot \frac{\partial V}{\partial \tilde{a}_1}} + \boxed{\frac{\partial J}{\partial V} \cdot \frac{\partial V}{\partial u} \cdot \frac{\partial u}{\partial \tilde{a}_2}}$$

$f(x, w, b)$

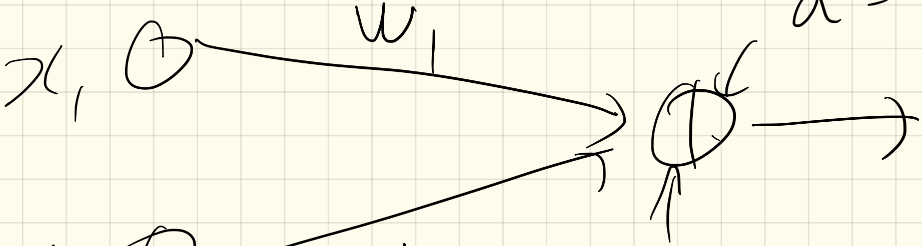


l-th layer $(l+1)$-th layer. $(l+2)$-th layer.



$w_{11}^{[l+1]}$
$w_{12}^{[l+1]}$
$a_1^{[l]}$
$a_2^{[l]}$
$b_1^{[l+1]}$
$z_1^{[l+1]}$
$a_1^{[l+1]}$

$a = \underline{\sigma}(z)$

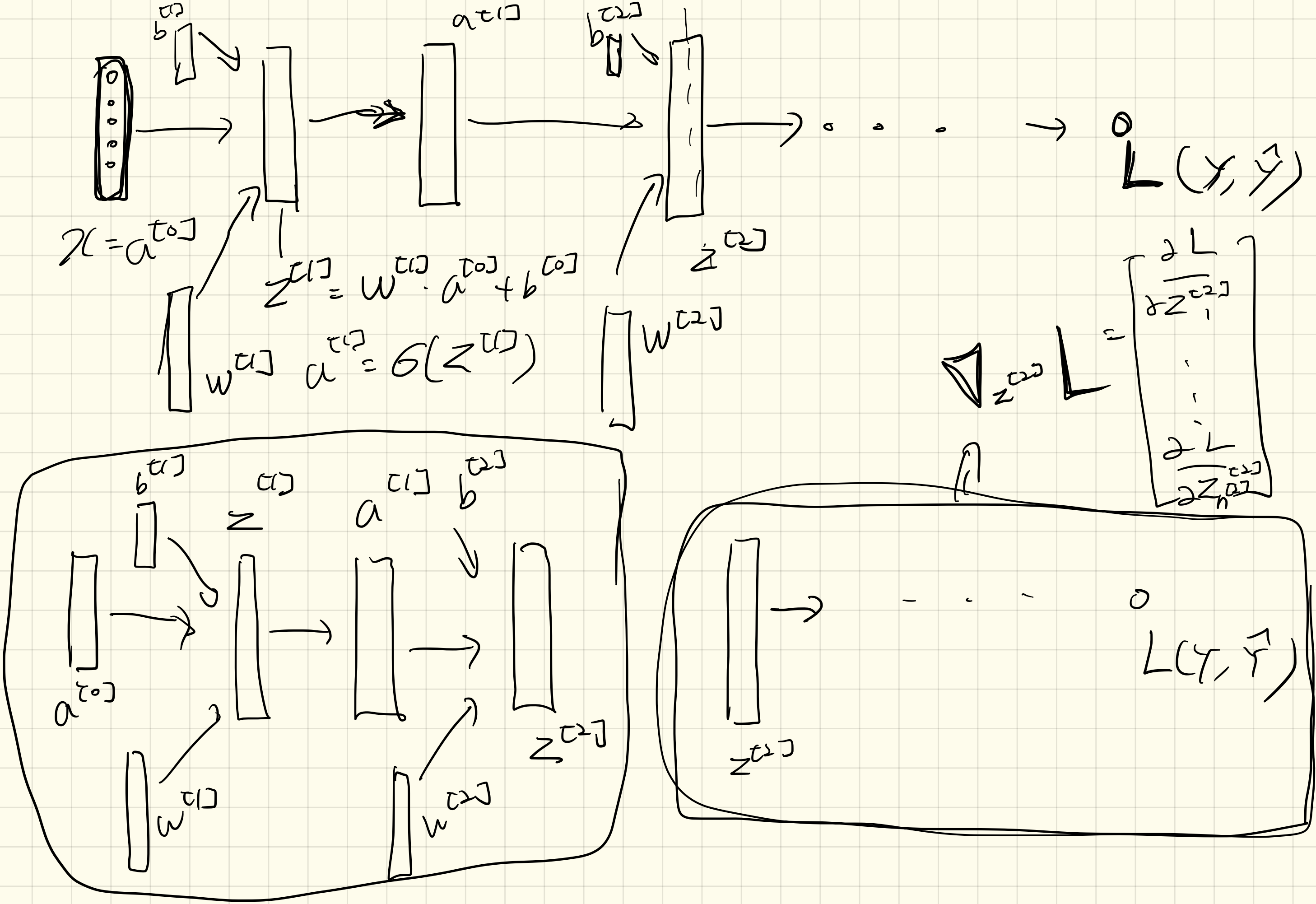


$z = w_1 x_1 + w_2 x_2$

$x_1 \in (-1, 1)$

$x_2 \in (-1, 1)$

$y \in (5, 10)$

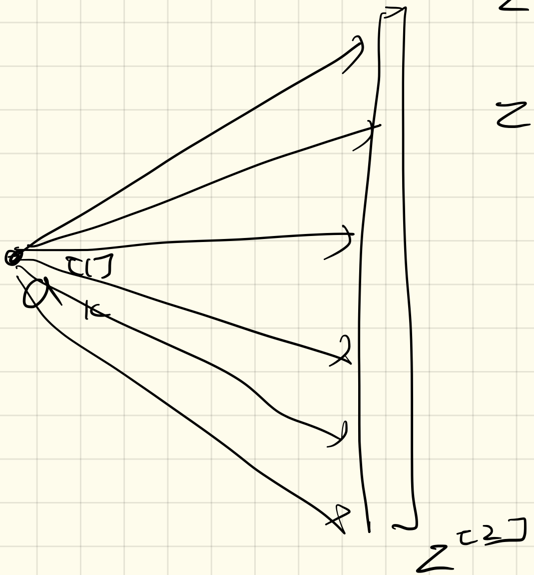


$b^{[1]}$
$a^{[1]}$
$b^{[2]}$
$L(y, \hat{y})$
$x = a^{[0]}$
$z^{[1]} = W^{[1]} \cdot a^{[0]} + b^{[0]}$
$z^{[2]}$
$W^{[1]}$
$a^{[1]} = \sigma(z^{[1]})$
$W^{[2]}$
$\nabla_{z^{[2]}} L = \begin{bmatrix} \frac{\partial L}{\partial z_1^{[2]}} \\ \vdots \\ \frac{\partial L}{\partial z_n^{[2]}} \end{bmatrix}$
$b^{[1]}$
$z^{[1]}$
$a^{[1]}$
$b^{[2]}$
$a^{[0]}$
$z^{[2]}$
$W^{[1]}$
$W^{[2]}$
$z^{[2]}$
$L(y, \hat{y})$

$$\nabla_{z^{[2]}} L = \begin{bmatrix} \frac{\partial L}{\partial z_1^{[2]}} \\ \vdots \\ \frac{\partial L}{\partial z_{n^{[2]}}^{[2]}} \end{bmatrix}$$

$$\frac{\partial L}{\partial z_i^{[2]}} = \lim_{\varepsilon \to 0} \frac{L(z_{-i}^{[2]}, z_i^{[2]} + \varepsilon) - L(z^{[2]})}{\varepsilon}$$

$$\frac{\partial L}{\partial a_k^{[1]}} = \sum_{i=1}^{n^{[2]}} \frac{\partial L}{\partial z_i^{[2]}} \cdot \frac{\partial z_i^{[2]}}{\partial a_k^{[1]}} \Rightarrow J \cdot \nabla_{z^{[2]}} L$$



$$z_1^{[2]} = \sum w_{1k}^{[2]} \cdot a_k^{[1]}$$

$$z_2^{[2]} = \sum w_{2k}^{[2]} \cdot a_k^{[1]}$$

$$\left\{ J \times J \times J \times \cdots \times \mathbb{V} \right\}$$