

$$h_1 \text{ input} = X_1 w_{11} + X_2 w_{21} + b_1$$
$$h_1 \text{ output} = \alpha(X_1 w_{11} + X_2 w_{21} + b_1)$$

$$h_2 \text{ input} = X_1 w_{12} + X_2 w_{22} + b_2$$

$$h_2 \text{ output} = \alpha(X_1 w_{12} + X_2 w_{22} + b_2)$$

$$h_3 \text{ input} = X_1 w_{13} + \cancel{X_2 w_{23}} + b_3$$

$$h_3 \text{ output} = \alpha(X_1 w_{13} + X_2 w_{23} + b_3)$$

$$h_4 \text{ input} = \cancel{X_1 w_{14}} + X_2 w_{24} + b_4$$

$$h_4 \text{ output} = \alpha(X_2 w_{24} + b_4)$$

$$\hat{Y}_{\text{input}} = h_1 \text{ out} \cdot V_1 + h_2 \text{ out} \cdot V_2 + h_3 \text{ out} \cdot V_3 + h_4 \text{ out} \cdot V_4$$
$$= \alpha(X_1 w_{11} + X_2 w_{21} + b_1) \cdot V_1 + \alpha(X_1 w_{12} + X_2 w_{22} + b_2) \cdot V_2$$
$$+ \alpha(X_1 w_{13} + X_2 w_{23} + b_3) \cdot V_3 + \alpha(X_1 w_{14} + X_2 w_{24} + b_4) \cdot V_4 + c$$

$$\hat{y}_{\text{out}} = \text{sigmoid}(\hat{y}^{\text{input}})$$

$$= \frac{1}{1 + e^{-\hat{y}^{\text{input}}}}$$

$$\begin{aligned} &= \frac{1}{1 + e^{-(a(x_1w_1 + x_2w_2 + b_1) \cdot v_1 + a(x_2w_2 + x_1w_3 + b_2) \cdot v_2 + a(x_1w_3 + x_2w_4 + b_3) \\ &\quad + a(x_1w_4 + x_2w_4 + b_4) \cdot v_4)})} \end{aligned}$$

3. see code