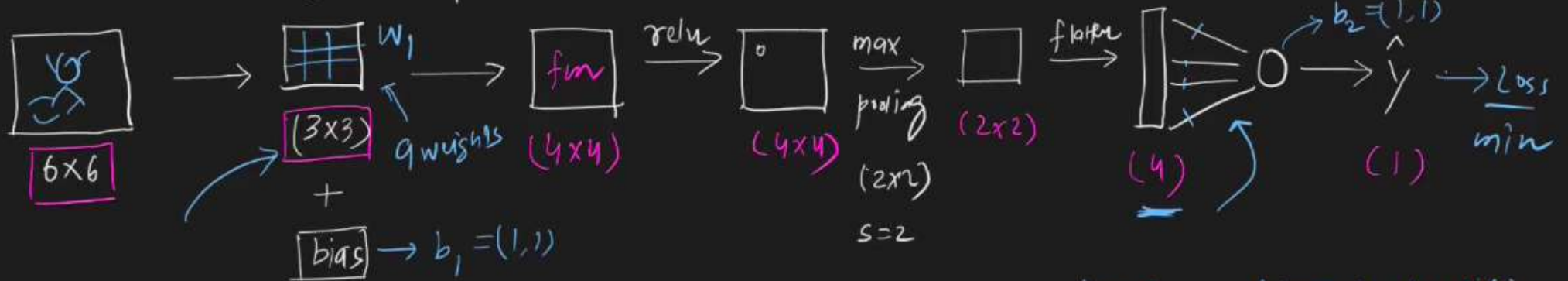


# Backpropagation in CNN

10 September 2022 11:12

↓ 1 conv layer → 1 filter + max pooling →



## Trainable Parameters

$$\begin{aligned} W_1 &= (3, 3) & W_2 &= (1, 4) \\ b_1 &= (1, 1) & b_2 &= (1, 1) \end{aligned} = \textcircled{15} \text{ trainable parameters}$$

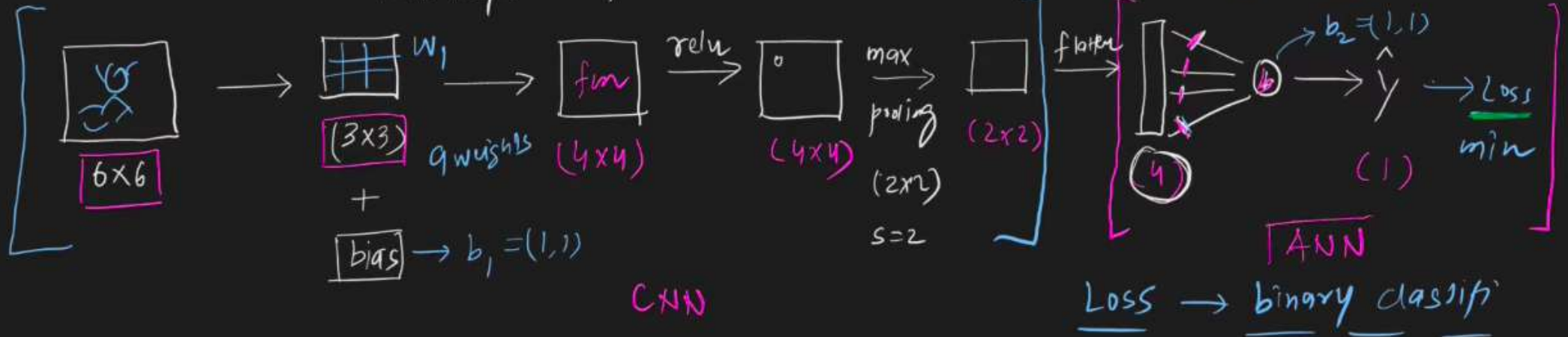
Loss → binary classification

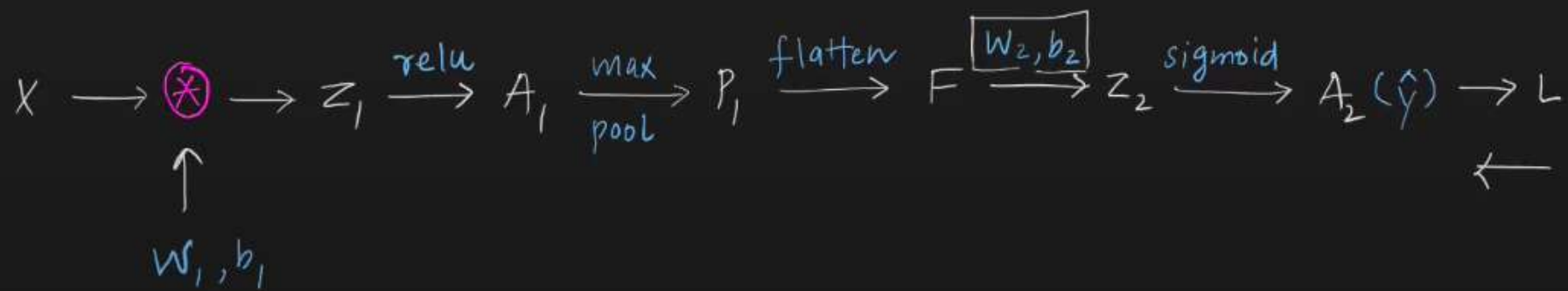
$$L = -y_i \log(\hat{y}_i) - (1 - y_i) \log(1 - \hat{y}_i)$$

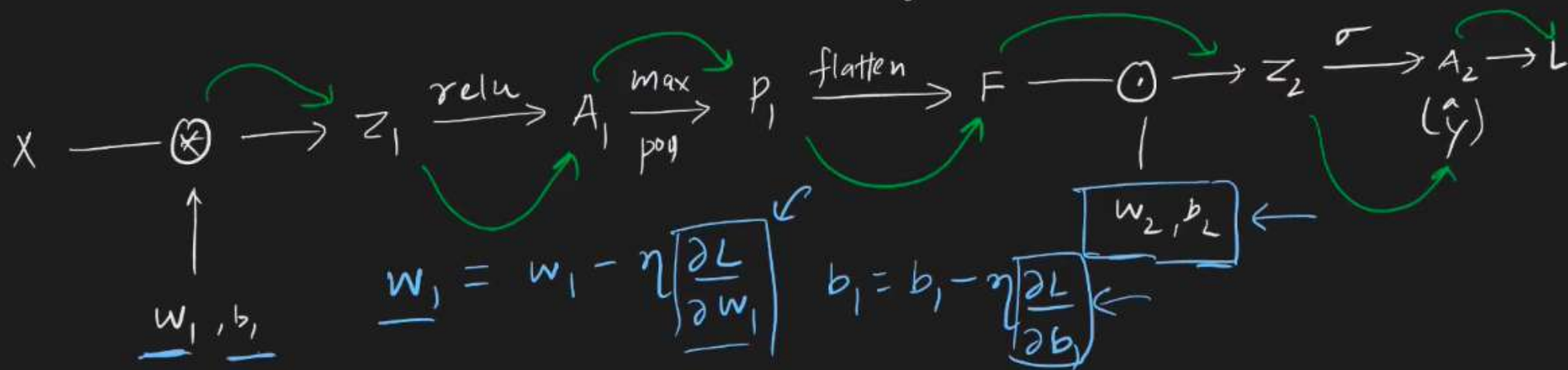
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11:12

1 conv layer  $\rightarrow$  1 filter + max pooling  $\rightarrow$







$$X = \begin{bmatrix} x_{11} & x_{12} & x_{13} \\ x_{21} & x_{22} & x_{23} \\ x_{31} & x_{32} & x_{33} \end{bmatrix} \quad W_1 = \begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \end{bmatrix}$$

$$z_{11} = x_{11}w_{11} + x_{12}w_{12} + x_{21}w_{21} + x_{22}w_{22} + b_1$$

$$z_{12} = x_{12}w_{11} + x_{13}w_{12} + x_{22}w_{21} + x_{23}w_{22} + b_1$$

$$z_{21} = x_{21}w_{11} + x_{22}w_{12} + x_{31}w_{21} + x_{32}w_{22} + b_1$$

$$z_{22} = x_{22}w_{11} + x_{23}w_{12} + x_{32}w_{21} + x_{33}w_{22} + b_1$$

$$Z_{11} = x_{11}w_{11} + x_{12}w_{12} + x_{21}w_{21} + x_{22}w_{22} + b_1$$

$$Z_{12} = x_{12}w_{11} + x_{13}w_{12} + x_{22}w_{21} + x_{23}w_{22} + b_1$$

$$Z_{21} = x_{21}w_{11} + x_{22}w_{12} + x_{31}w_{21} + x_{32}w_{22} + b_1$$

$$Z_{22} = x_{22}w_{11} + x_{23}w_{12} + x_{32}w_{21} + x_{33}w_{22} + b_1$$