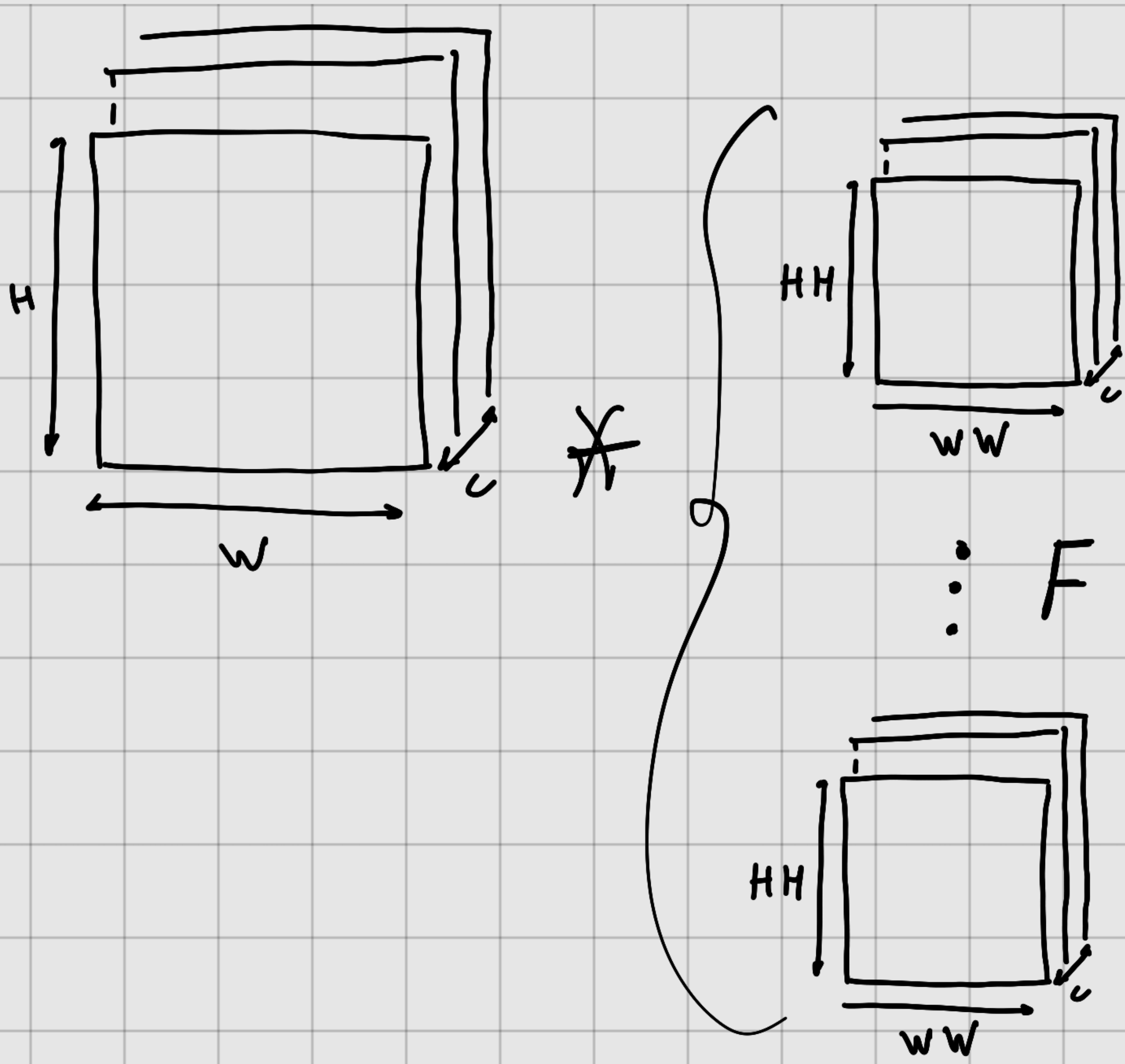

given $Z = X * W + b$

equation 1

$$\overbrace{\frac{\partial Z}{\partial b}}^{(F,\ )} = \sum_{i=1}^{N} \sum_{h=1}^{H'} \sum_{w=1}^{W'} \overbrace{\frac{\partial L}{\partial Z}}^{(N, F, H', W')}$$

we sum over the first, third, and fourth dimension

equation 2 (N, F, H, W) ; (N, F, H', W')

equation 2 (N, F, H', W') . (N, C, H, W)

$$\frac{\partial L}{\partial w} = \overbrace{\sum_{n=1}^{N} \sum_{h=1}^{H'} \sum_{w=1}^{W'} x_n \cdot \frac{\partial L}{\partial z}}$$

(F, C, HH, WW)

equation 3 (F, C, HH, WW) . (N, F, H', W')

(N, C, H, W)

$$\frac{\partial L}{\partial x} = \overbrace{\sum_{f=1}^{F} \sum_{h=1}^{H'} \sum_{j=1}^{W'} \left(w_f \cdot \frac{\partial L}{\partial z} \right)}$$

where w_f is the flipped version of w.

I found that the nested loop logic takes care of the flipping so no need for explicit declaration.