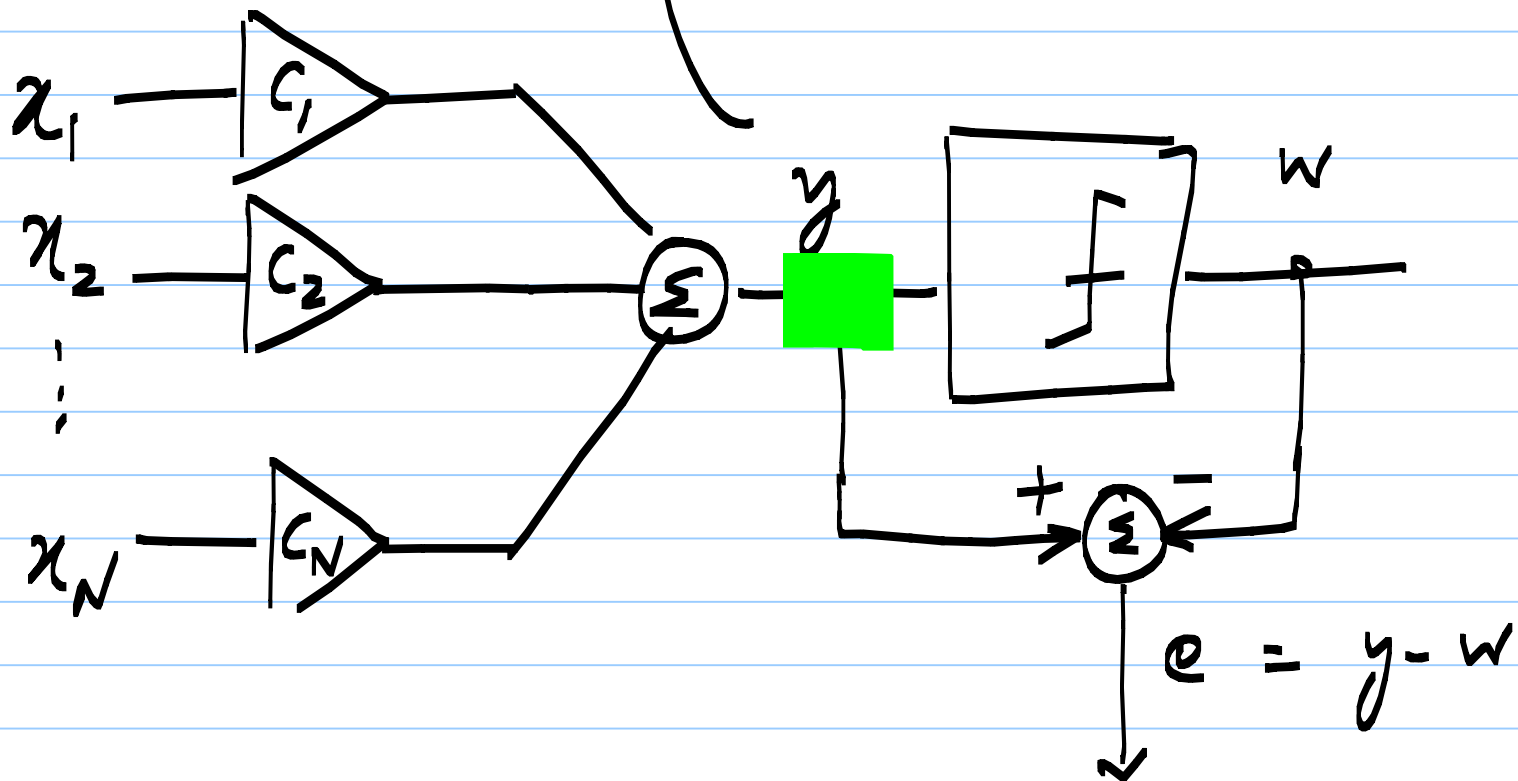


Adaptation:



Minimize the mean-squared value of  $e$

$$e^2 = (y - w)^2 \quad e = (y - w)$$

$$= \left( \sum_k c_k x_k - w \right)^2$$

$$\frac{\partial e^2}{\partial c_l} = 2e \cdot \frac{\partial e}{\partial c_l} = 2e x_l$$

rate control

Gradient descent algorithm

$$c_l[n+1] = c_l[n] - \mu \cdot e x_l$$

Coeff. update: Gradient descent algorithm:

$$c_l[n+1] = c_l[n] - \mu \cdot e[n] \cdot x_l[n]$$

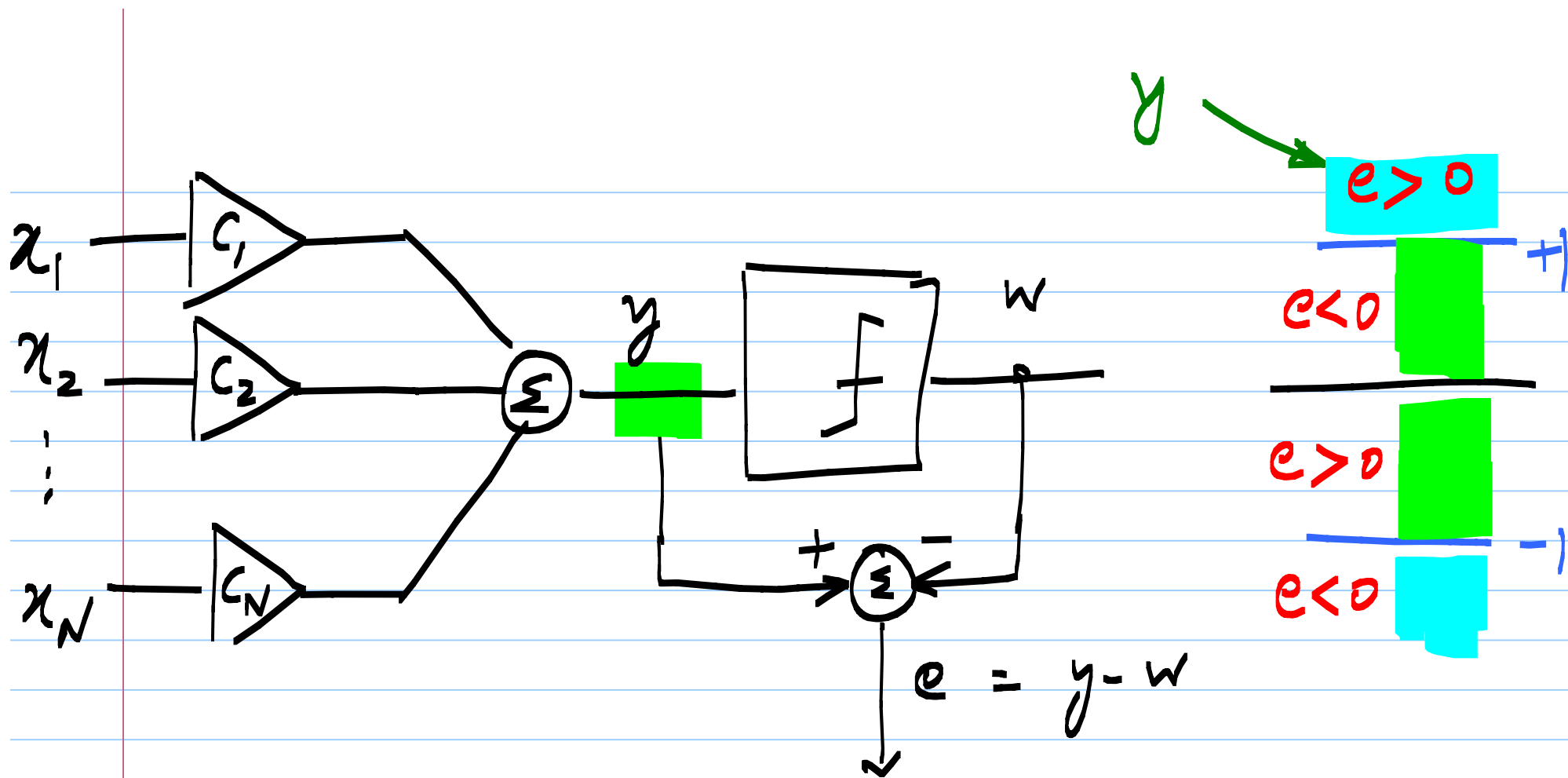
Multiplication = difficult

Simplified version.

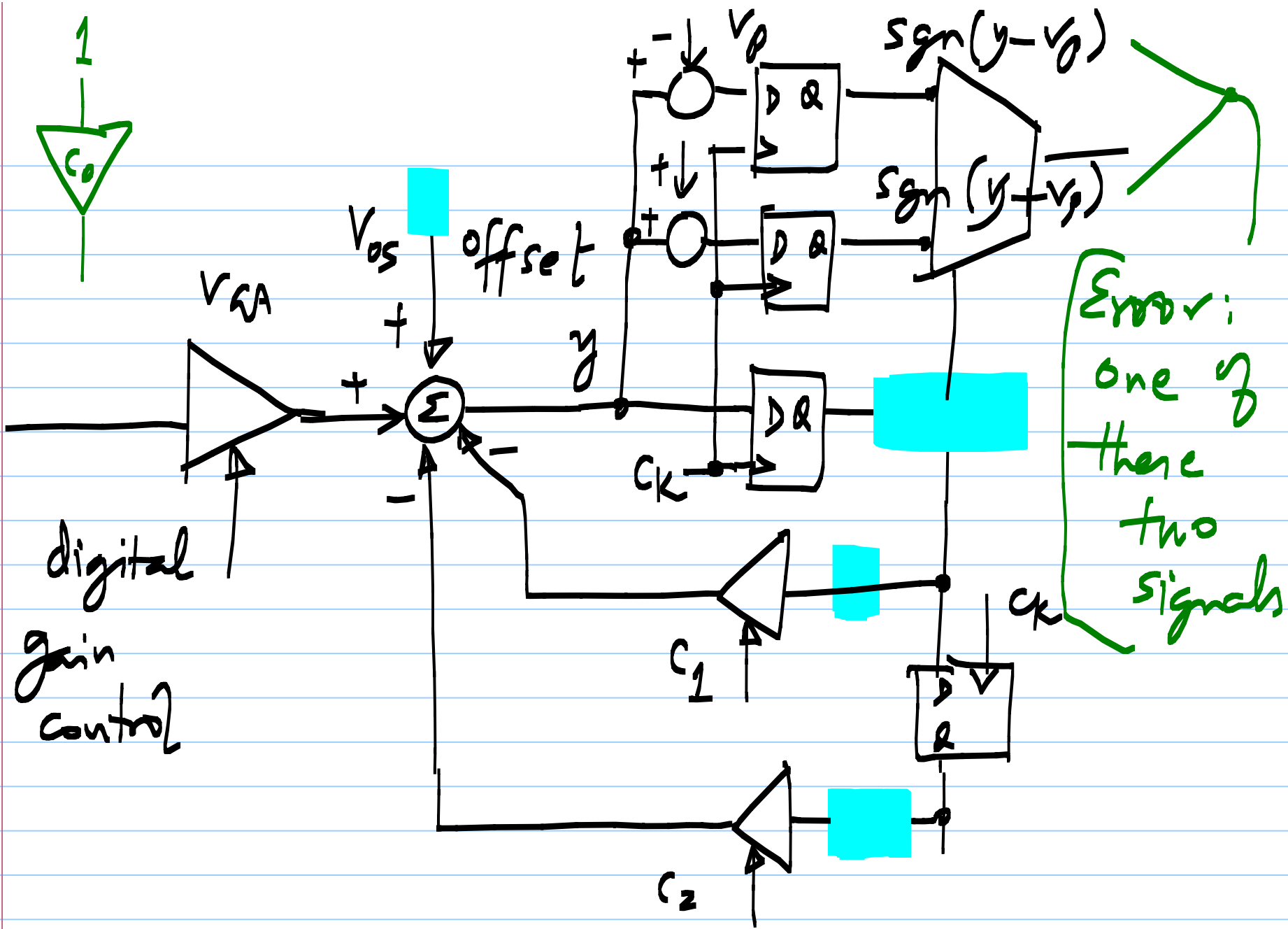
$$c_l[n+1] = c_l[n] - \mu \operatorname{sgn}(e[n]) \cdot x_l[n]$$

$$c_l[n+1] = c_l[n] - \mu e[n] \operatorname{sgn}(x_l[n])$$

$$c_l[n+1] = c_l[n] - \mu \operatorname{sgn}(e[n]) \operatorname{sgn}(x_l[n])$$



$$c_l[n+1] = c_l[n] - \mu \operatorname{sgn}(e[n]) \operatorname{sgn}(x_l[n])$$



Error: one of these two signals

