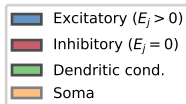


(A) Compartmental dendritic neuron

Excitatory
inputs x_j^E



shunting:
I enters
denominator

g^{den}

Soma

V_{out}

output

$$V_n = \frac{\sum_j E_j x_j g_j^{\text{syn}} + \sum_j V_j g_j^{\text{den}}}{\sum_j x_j g_j^{\text{syn}} + \sum_j g_j^{\text{den}} + 1}$$

(sums include both E and I synapses per branch)

(B) Local learning rule hierarchy

3F

$$\Delta g \propto x_j \cdot (E_j - V_n) \cdot \delta$$

pre-synaptic × driving force × broadcast error

4F

$$\Delta g \propto x_j \cdot (E_j - V_n) \cdot \delta \cdot \rho$$

+ variance / EMA modulator ρ

5F

$$\Delta g \propto x_j \cdot (E_j - V_n) \cdot \delta \cdot \rho \cdot \phi$$

+ information-theoretic factor ϕ

Broadcast error δ : scalar / per-soma / local mismatch