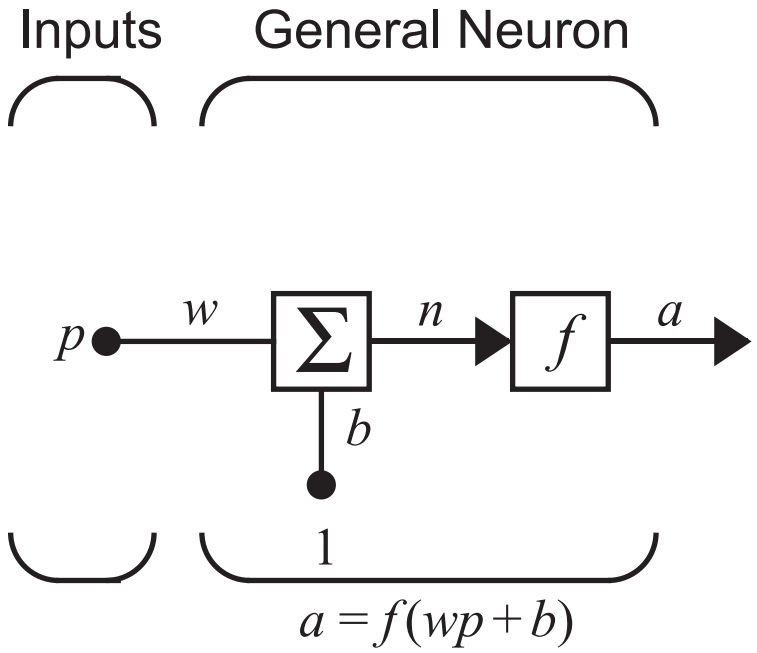
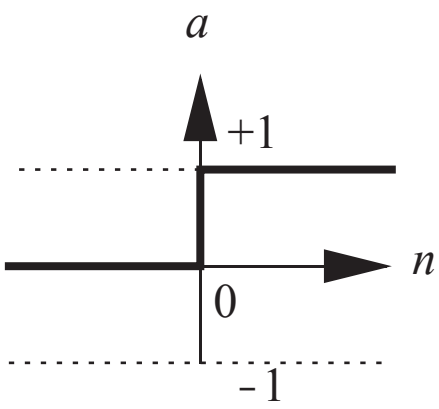
2

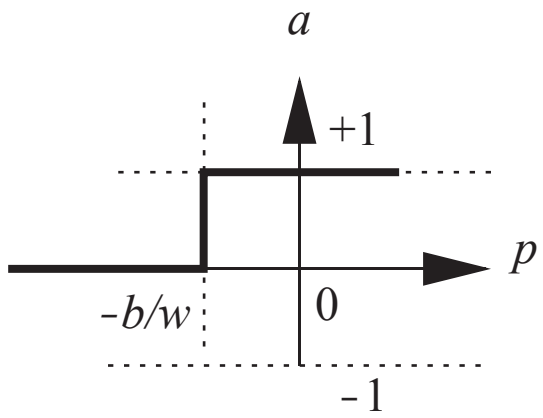
Neuron Model and Network Architectures

Single-Input Neuron



Transfer Functions



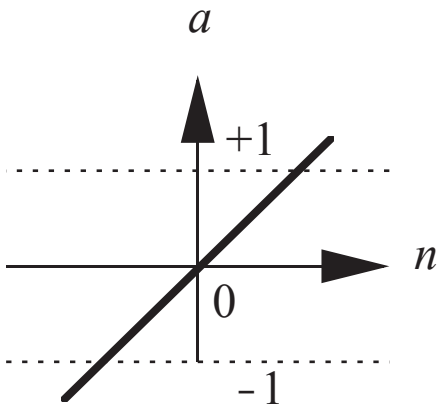


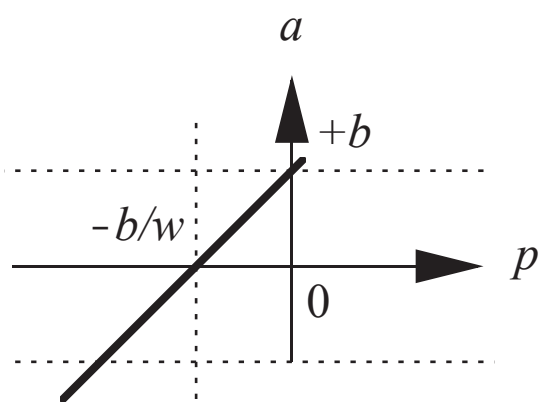
$a = hardlim(n)$

Hard Limit Transfer Function

$a = hardlim(wp + b)$

Single-Input *hardlim* Neuron





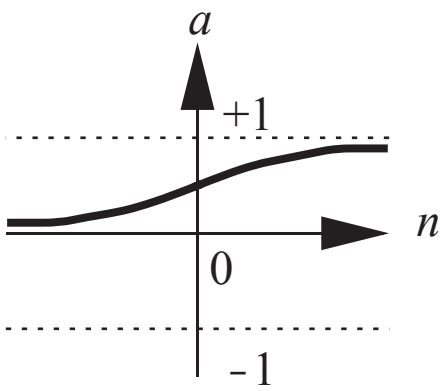
$a = purelin(n)$

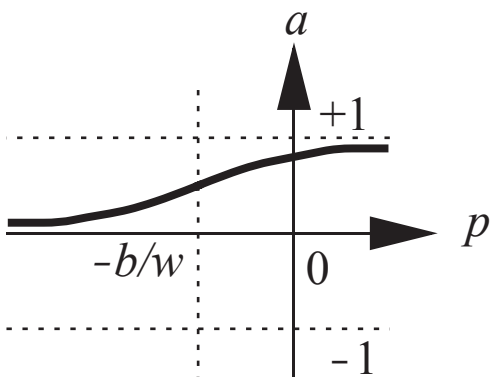
Linear Transfer Function

$a = purelin(wp + b)$

Single-Input *purelin* Neuron

Transfer Functions





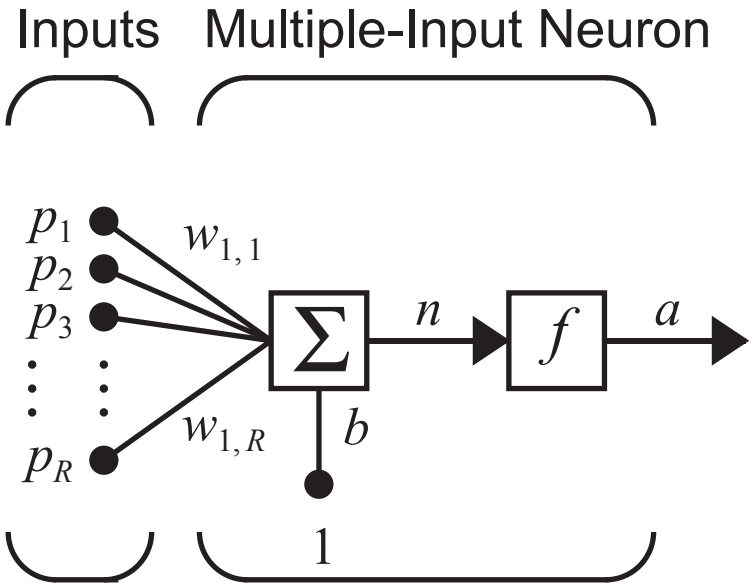
$a = logsig(n)$

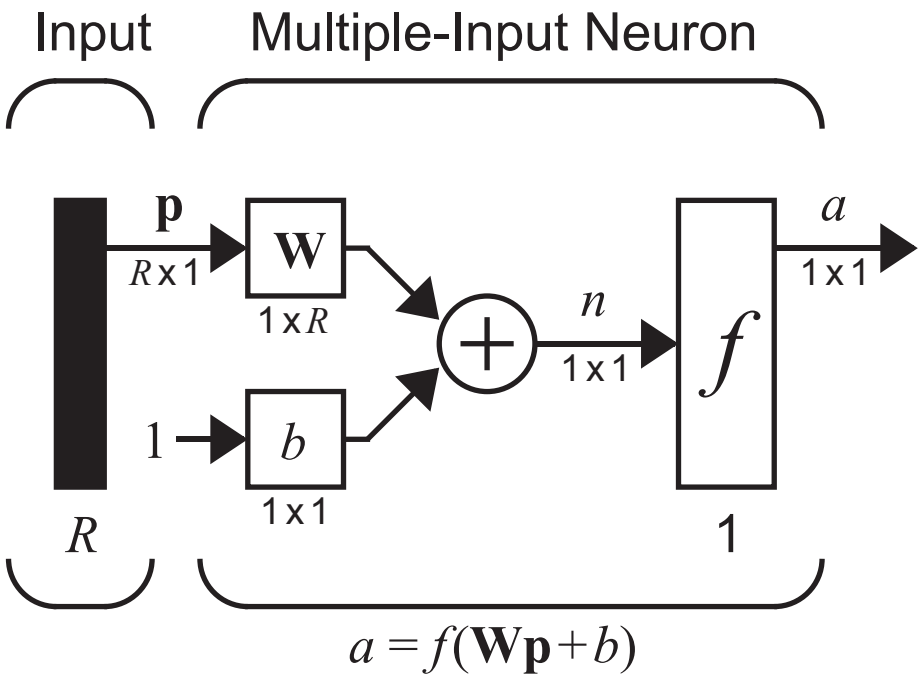
Log-Sigmoid Transfer Function

$a = logsig(wp + b)$

Single-Input *logsig* Neuron

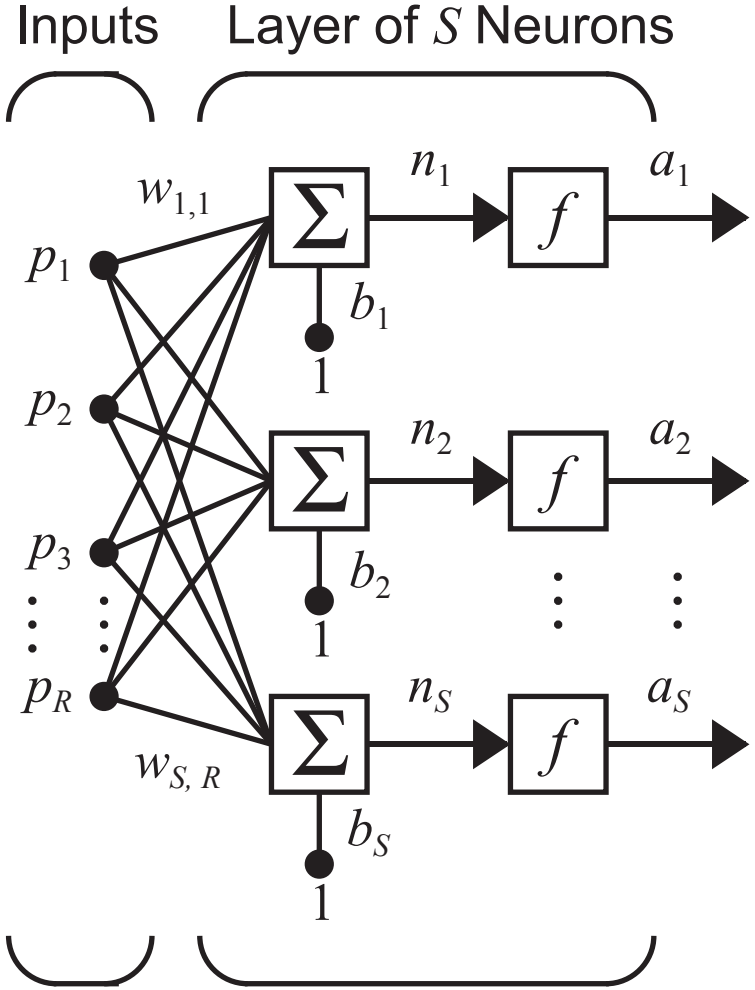
2 Multiple-Input Neuron



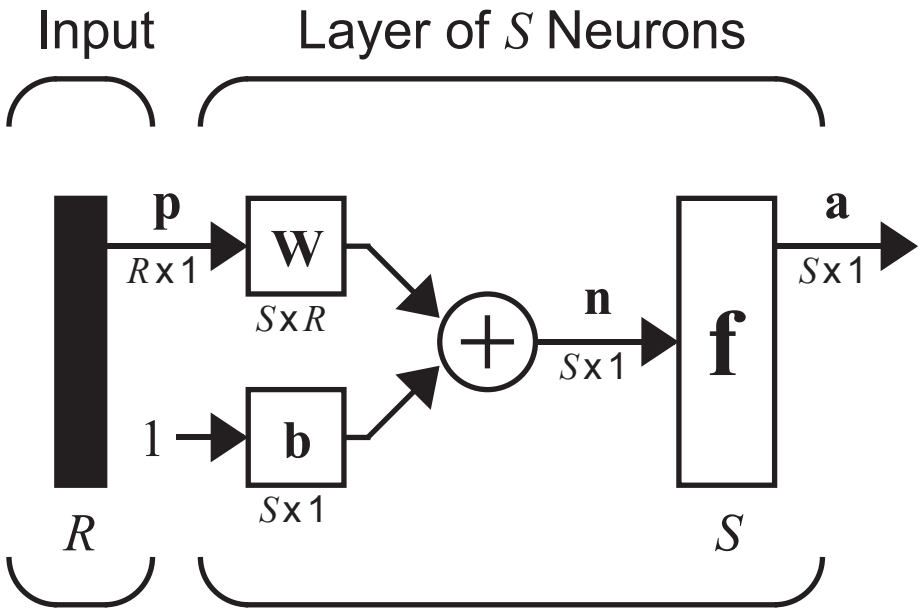


Abreviated Notation

2 Layer of Neurons



2 Abbreviated Notation

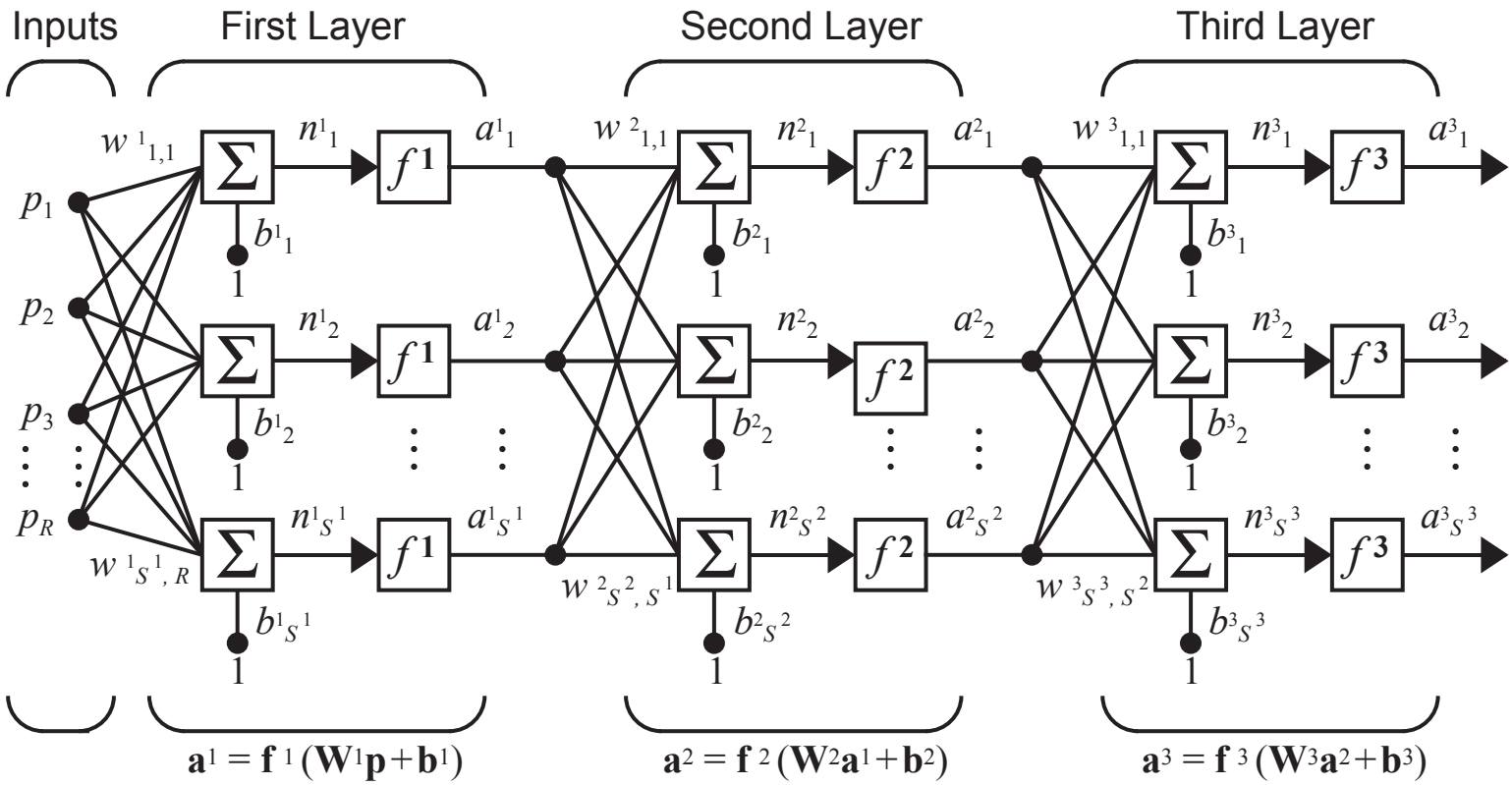


$$\mathbf{a} = \mathbf{f}(\mathbf{W}\mathbf{p} + \mathbf{b})$$

$$\mathbf{W} = \begin{bmatrix} w_{1,1} & w_{1,2} & \cdots & w_{1,R} \\ w_{2,1} & w_{2,2} & \cdots & w_{2,R} \\ \vdots & \vdots & & \vdots \\ w_{S,1} & w_{S,2} & \cdots & w_{S,R} \end{bmatrix}$$

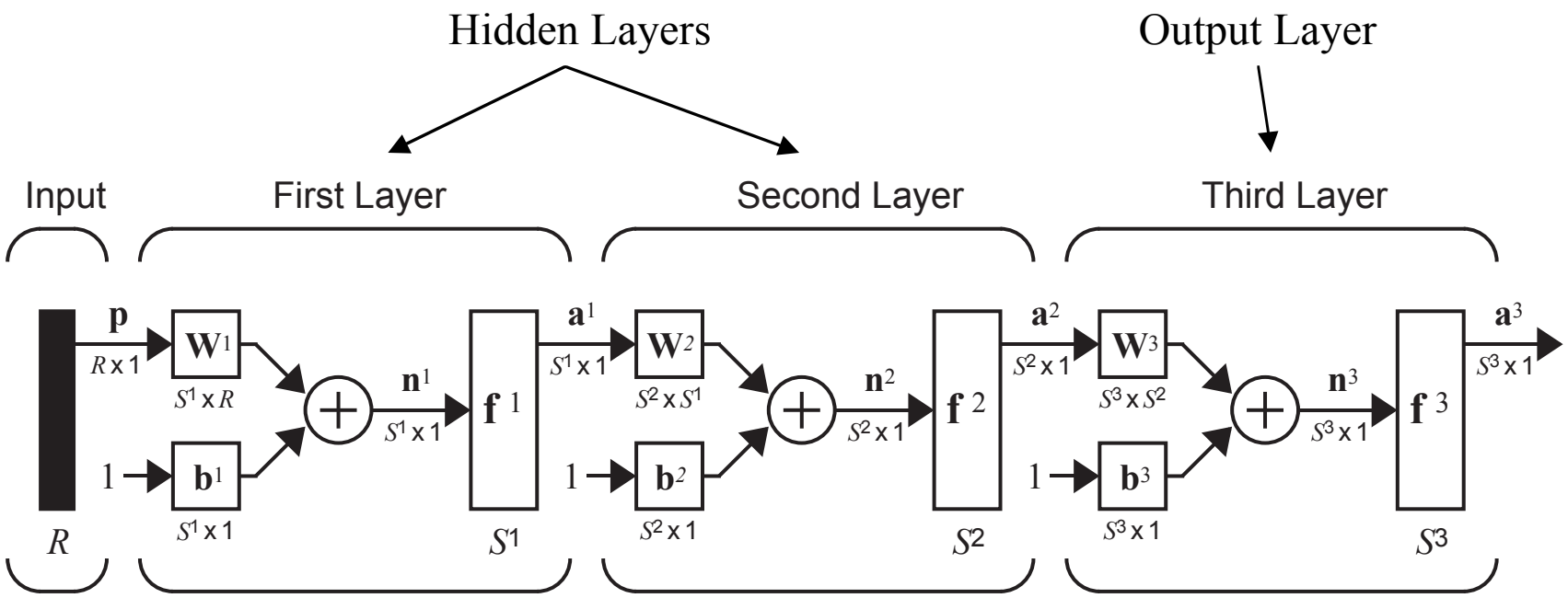
$$\mathbf{p} = \begin{bmatrix} p_1 \\ p_2 \\ \vdots \\ p_R \end{bmatrix} \quad \mathbf{b} = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_S \end{bmatrix} \quad \mathbf{a} = \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_S \end{bmatrix}$$

2 Multilayer Network



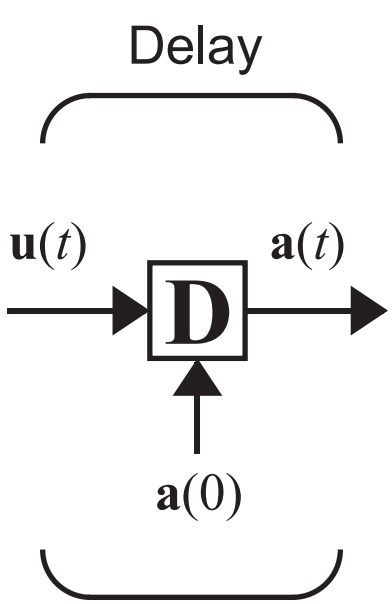
$$\mathbf{a}^3 = \mathbf{f}^3(\mathbf{W}^3\mathbf{f}^2(\mathbf{W}^2\mathbf{f}^1(\mathbf{W}^1\mathbf{p}+\mathbf{b}^1)+\mathbf{b}^2)+\mathbf{b}^3)$$

2 Abreviated Notation

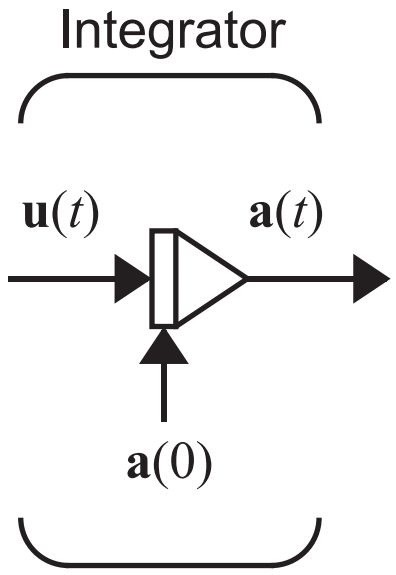


$$\mathbf{a}^3 = \mathbf{f}^3(\mathbf{W}^3\mathbf{f}^2(\mathbf{W}^2\mathbf{f}^1(\mathbf{W}^1\mathbf{p}+\mathbf{b}^1)+\mathbf{b}^2)+\mathbf{b}^3)$$

2 Delays and Integrators

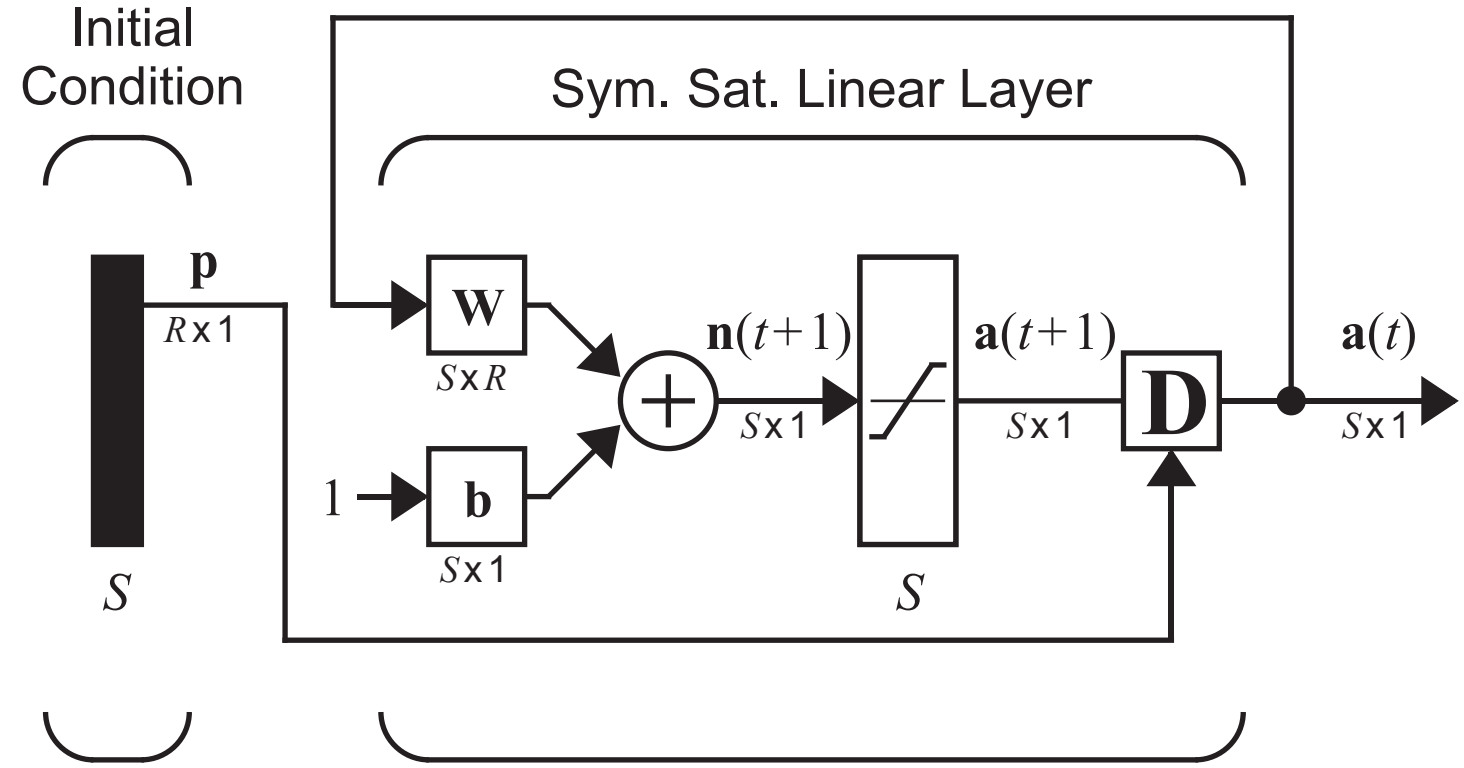


$$\mathbf{a}(t) = \mathbf{u}(t - 1)$$



$$\mathbf{a}(t) = \int_0^t \mathbf{u}(\tau)\, d\tau + \mathbf{a}(0)$$

Recurrent Network



$$\mathbf{a}(0) = \mathbf{p} \qquad \mathbf{a}(t+1) = \mathbf{satlin}(\mathbf{W}\mathbf{a}(t)+\mathbf{b})$$

$$\mathbf{a}(1) = \mathbf{satlins}(\mathbf{W}\mathbf{a}(0)+\mathbf{b}) = \mathbf{satlins}(\mathbf{W}\mathbf{p}+\mathbf{b})$$

$$\mathbf{a}(2) = \mathbf{satlins}(\mathbf{W}\mathbf{a}(1)+\mathbf{b})$$