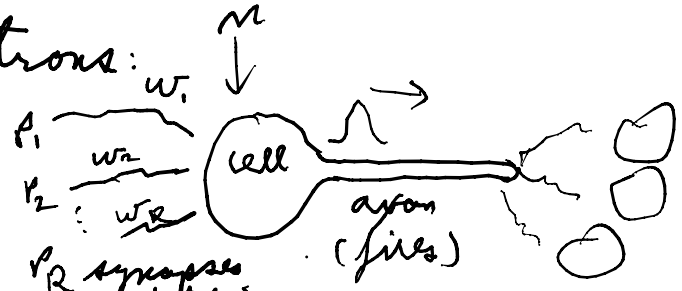
EE 434
02/01/05

Perceptrons:



p_R synapses (weights) any real #

$a \in [0\ 1]$

$+$ = excites

$-$ = inhibits

$$\sum_{i=1}^{R} w_i p_i = n$$

threshold of stimulability $\Rightarrow$ if greater than then fire (here use 0)

p. 4-4

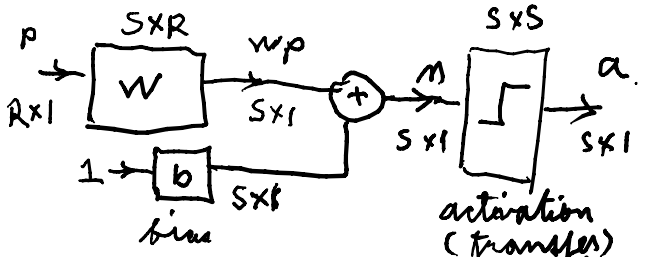


Figure 4.1 Perceptron

5 units step functions; $1(x) = \begin{cases} 0 & x \leq 0 \\ 1 & x > 0 \end{cases}$

$n = Wp + b$

$$a_i = 1\left(b_i + \sum_{j=1}^{R} W_{ij} p_j\right); \quad i = 1, 2 \cdots S$$

02/03/05

p are real R-vectors

W are real $S \times R$ matrices, b = $S \times 1$ real vector

Example: $R = 1$, $S = 1$

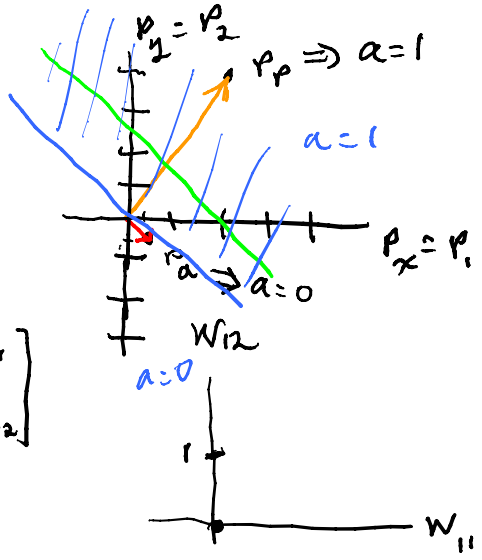
$$p_a = \begin{bmatrix} 0.2 \\ -0.5 \end{bmatrix}, \quad p_b = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$$

desired outputs $t_a = 0$, $t_b = 1$

$Wp + b$;

$$W = \begin{bmatrix} W_{11} & W_{12} \end{bmatrix}; \quad w = \begin{bmatrix} W_{11} \\ W_{12} \end{bmatrix}$$

$= w^T$



Let's choose $b = [0]$

$n = Wp = \begin{bmatrix} W_{11} & W_{12} \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \end{bmatrix} = W_{11} p_1 + W_{12} p_2$ $\begin{cases} \text{gives 0 output} \\ \text{if } \leq 0 \\ \text{gives 1 output} \\ \text{if } > 0 \end{cases}$

note: separates outputs 0 from outputs 1 when $W_{11} p_1 + W_{12} p_2 = 0 \Rightarrow p_2 = -\frac{W_{11}}{W_{12}} p_1$

as p_a & p_b are given desire to choose the W

for $p_a = \begin{bmatrix} 0.2 \\ -0.5 \end{bmatrix}$; $W_{11} \times 0.2 + W_{12}(-0.5) < 0$

for $p_b = \begin{bmatrix} 2 \\ 4 \end{bmatrix}$; $W_{11} \times 2 + W_{12} \times 4 > 0$

can choose W_{11} & W_{12} to satisfy this

one choice is $W_{11} = 0$, $W_{12} = 1$ then for $p_a \Rightarrow -0.5 < 0$

for $p_b \Rightarrow 4 > 0$