IFA-305 Sistem Cerdas (Intelligent System)
Lecture 5

Rosenblatt's Perceptron – Part 2: Backward Computation (Learning)

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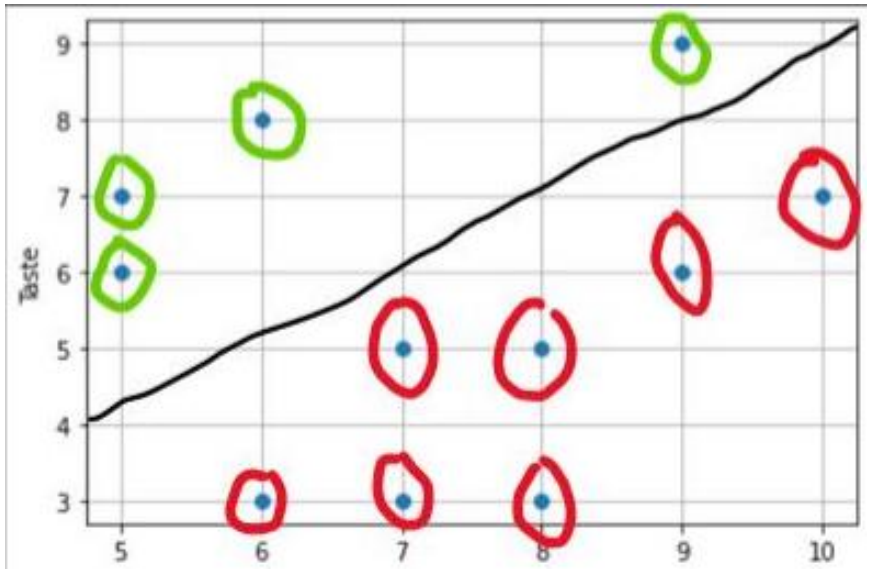
Tangerang Selatan

Previous Homework: Restaurant Survey

Price (x_1)	Taste (x_2)	Buy ? (d)
5	6	Yes 1
5	7	Yes 1
6	3	No 0
6	8	Yes 1
7	3	No 0
7	5	No
8	3	No
8	5	No
9	6	No
9	9	Yes
10	7	No 0



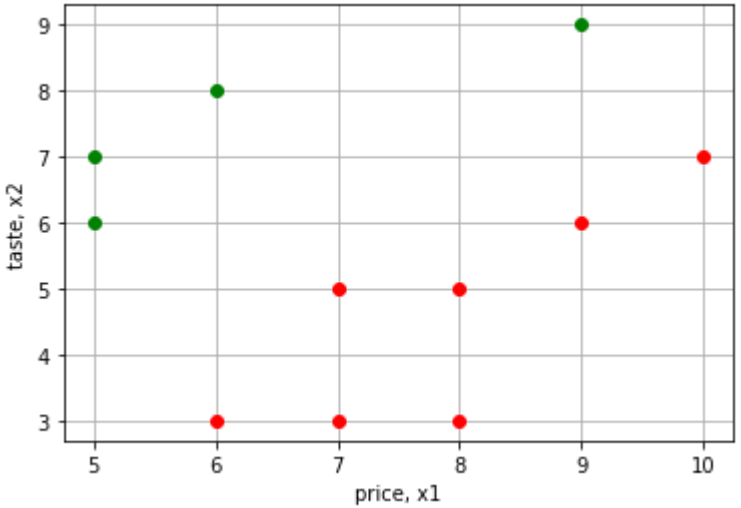
$x_1 = [5, 5, 6, \ldots 10]$

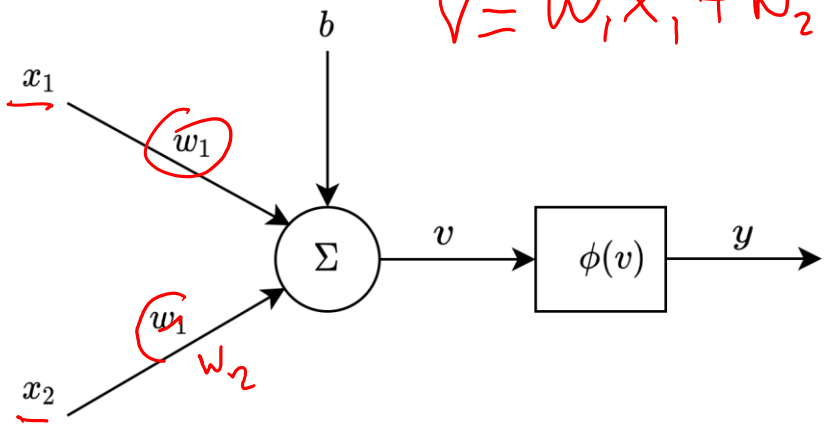
$x_2 = [6, 7, 3, \ldots 7]$

$d = [1, 1, 0, \ldots 0]$

Previous Homework: Restaurant Survey

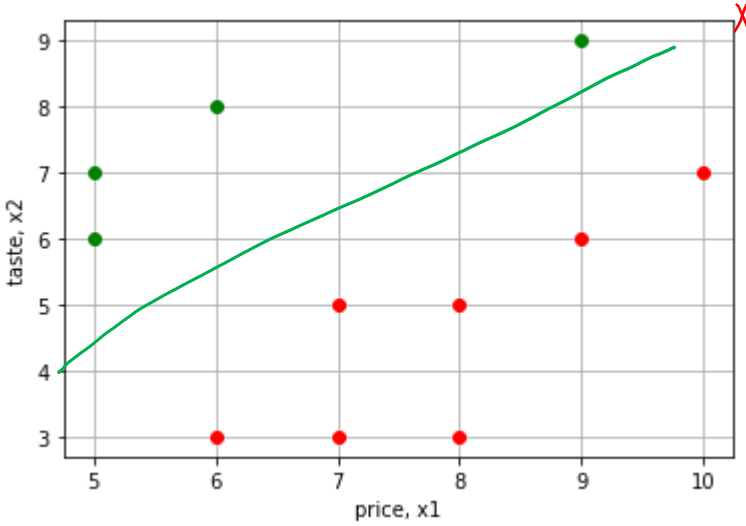
Price	Taste	Buy ?
5	6	Yes
5	7	Yes
6	3	No
6	8	Yes
7	3	No
7	5	No
8	3	No
8	5	No
9	6	No
9	9	Yes
10	7	No

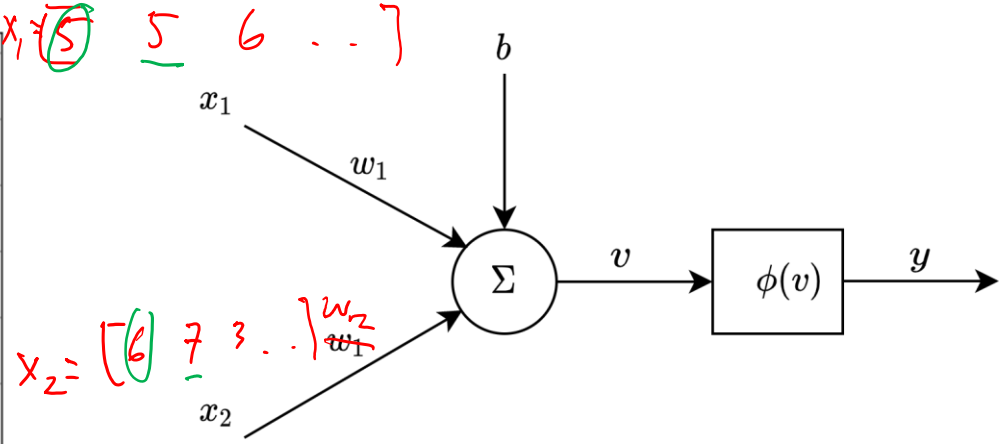




$v = w_1 x_1 + w_2 x_2 + b$

Previous Homework: Restaurant Survey





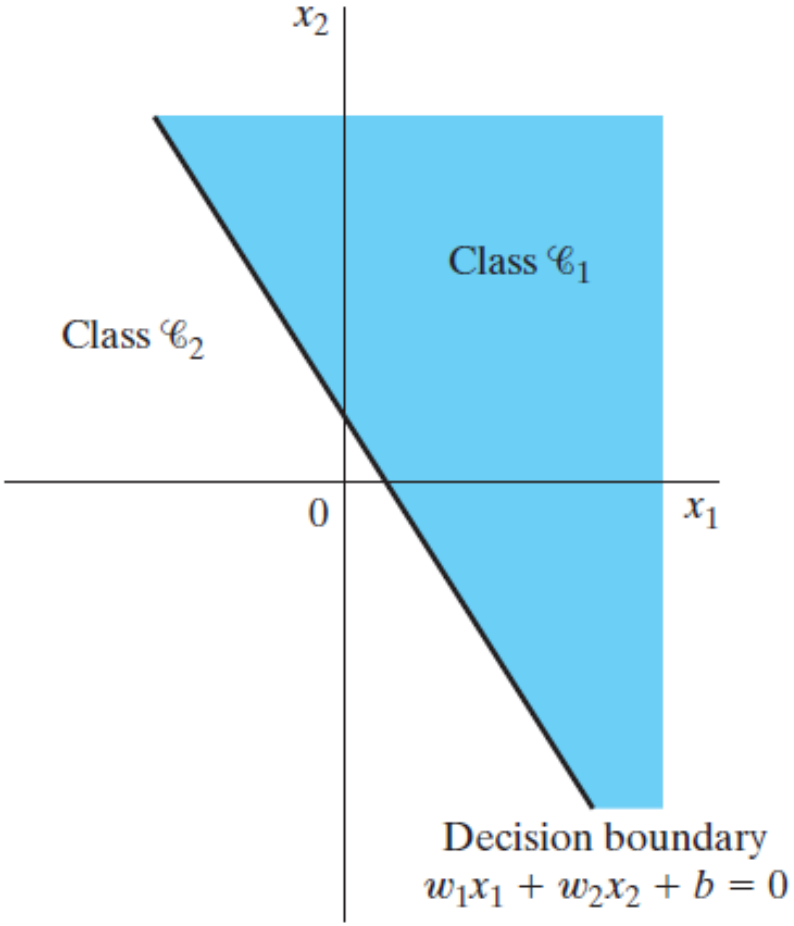
$$v = w_1x_1 + w_2x_2 + b$$

$$v = [w_1 \quad w_2]\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + b$$

$$v = wx + b$$

$$y = \phi(v)$$

Decision Boundary



$$v = w_1x_1 + w_2x_2 + b$$

$$y = \phi(v)$$

$$\phi(v) = \begin{cases} 1, & \text{for } v \geq 0 \\ 0, & \text{for } v < 0 \end{cases}$$

Boundary:

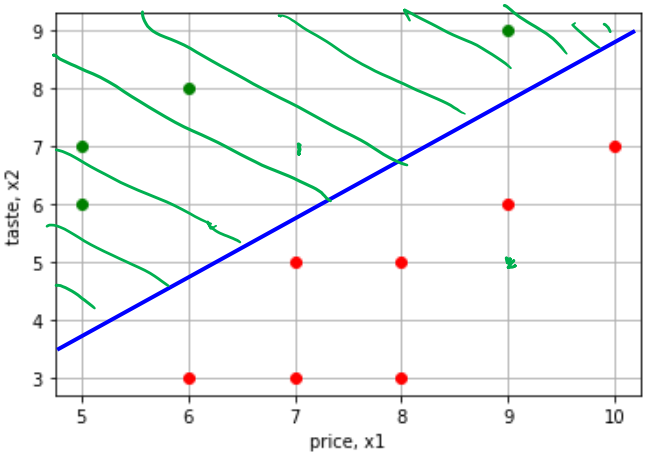
$$v = 0$$

$$w_1x_1 + w_2x_2 + b = 0$$

$$x_2 = -\frac{w_1}{w_2}x_1 - \frac{b}{w_2}$$

Previous Homework: Restaurant Survey

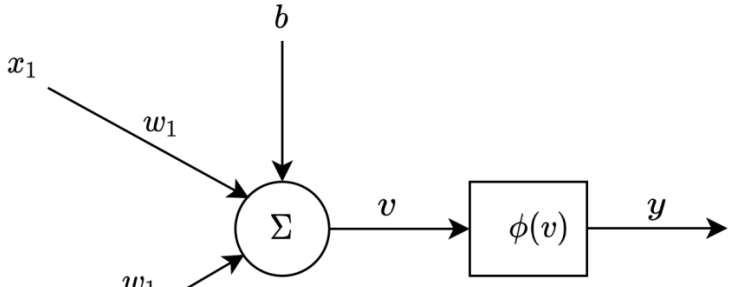
Price (x1)	Taste (x2)	Buy ?	d
5	6	Yes	1
5	7	Yes	1
6	3	No	0
6	8	Yes	1
7	3	No	0
7	5	No	0
8	3	No	0
8	5	No	0
9	6	No	0
9	9	Yes	1
10	7	No	0



Decision boundary:

$w_1 x_1 + w_2 x_2 + b = 0$

$$x_2 = -\frac{w_1}{w_2} x_1 - \frac{b}{w_2}$$



$$v = wx + b$$

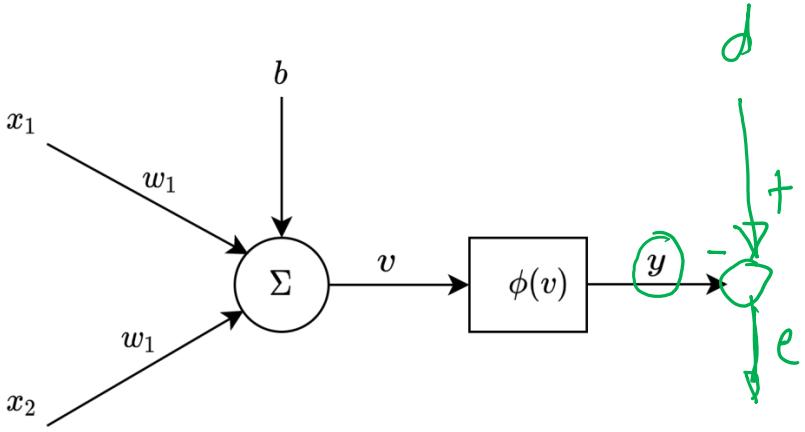
$$y = \phi(v)$$

Learning Algorithm

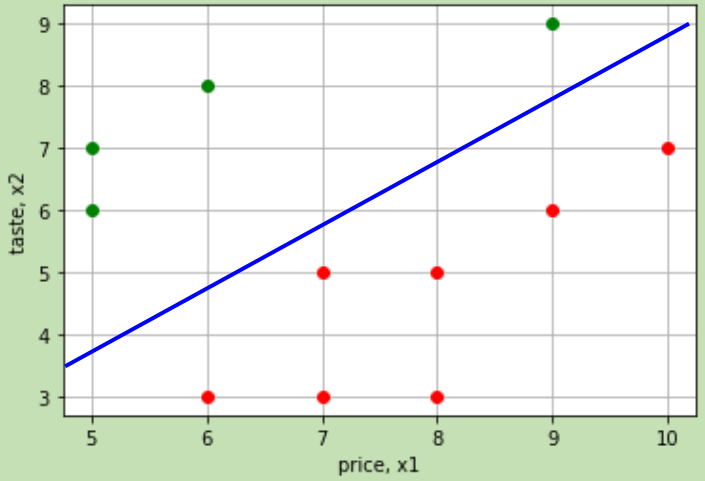
$$\mathbf{w}(n+1) = \mathbf{w}(n) + \eta[d(n) - y(n)]\mathbf{x}(n)$$

where:

- $\mathbf{w}$ is the weight vector
- $\mathbf{x}$ is the input vector
- η is the learning rate $(0 < \eta \leq 1)$
- d is the desired output
- y is the perceptron output
- n is the iteration index



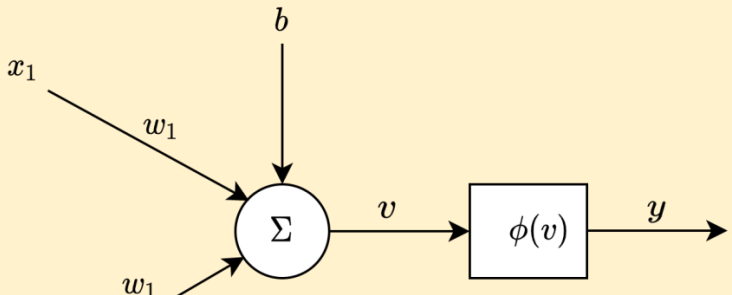
Learning Algorithm (2)



Decision boundary:

$w_1 x_1 + w_2 x_2 + b = 0$

$$x_2 = -\frac{w_1}{w_2} x_1 - \frac{b}{w_2}$$



$$v = wx + b$$

$$y = \phi(v)$$

Learning algorithm:

$$w(n+1) = w(n) + \eta[d(n) - y(n)]x(n)$$

Example 1: Grading

Mid	Final	Grade
60	50	Fail
70	60	Pass
40	80	Pass
60	65	Pass
80	50	Pass
70	50	Fail
65	55	Fail
30	80	Pass
80	40	Fail
90	30	Fail
50	70	Pass

Plot the grade using Python !