

MACHINE LEARNING BIOINFORMATICS.

HOME Assignment 1.

1. Given,

$$x_1 = (1, 2, 0)^T, y_1 = +1$$

$$x_2 = (1, 2, 2)^T, y_2 = +1$$

$$x_3 = (1, 0, 2)^T, y_3 = -1$$

$$\text{Initial } w = [0, 6, 6]^T$$

$$[w_0, w_1, w_2]^T = [0, 6, 6]^T$$

$$z = (5 \times 1) + (0 \times 0) + (1 \times 1) = 6$$

$$w^T x_1 = x_0 w_0 + x_1 w_1 + x_2 w_2 \quad (2) \text{ ng } 2 =$$

$$\Rightarrow (1 \times 0) + (2 \times 6) + (0 \times 6) = 12$$

$$\Rightarrow \text{sign}(12) = +1 \text{ (Matches } y_1)$$

$$w^T x_2 = x_0 w_0 + x_1 w_1 + x_2 w_2$$

$$\Rightarrow (1 \times 0) + (2 \times 6) + (2 \times 6) = 24$$

$$\Rightarrow \text{sign}(24) = +1 \text{ (Matches } y_2)$$

$$w^T x_3 = x_0 w_0 + x_1 w_1 + x_2 w_2$$

$$\Rightarrow (1 \times 0) + (0 \times 6) + (2 \times 6) = 12$$

$$\Rightarrow \text{sign}(12) \neq -1 \text{ (doesn't match } y_3)$$

Perceptron updated rule is

$$w_{\text{new}} = w_{\text{old}} + y * x$$

x_3 :

$$w_{\text{new}} = [0, 6, 6]^T + (-1) * [1, 0, 2]^T \quad (0 < 1) \quad \leftarrow$$

$$= [0, 6, 6]^T - [1, 0, 2]^T \quad (1 > 0) \quad \leftarrow$$

$$w = [-1, 6, 4]^T \quad (1 < 0) \quad \leftarrow$$

repeat steps.

$$w^T x_3 = [-1, 6, 4]^T * [1, 0, 2]^T$$

$$= (-1 \times 1) + (6 \times 0) + (4 \times 2) = 8$$

$$= \text{sign}(8) \neq -1 \quad \leftarrow$$

update w as $w_{\text{new}} = (0 \times 0) + (0 \times 6) + (0 \times 1) \leftarrow$

$$w^T x_3 = [-1, 6, 4]^T + 1 * -1 * [1, 0, 2]^T \quad \leftarrow$$

$$= [-1, 6, 4]^T - [1, 0, 2]^T + 0 \times 0 = -2 \times 1 \quad \leftarrow$$

$$= [-2, 6, 2]^T \quad (0 \times 0) + (0 \times 1) \quad \leftarrow$$

$$\text{new } w = [-2, 6, 2]^T \quad (1 < 0) \quad \leftarrow$$

$$w^T x_4 = [-2, 6, 2]^T * [1, 0, 2]^T \quad \leftarrow$$

$$= (-2 \times 1) + (6 \times 0) + (2 \times 2) \quad \leftarrow$$

$$= (-2 + 0 + 4) \quad \leftarrow$$

update w as new w

$$= [-2, 6, 2]^T + 1 * -1 * [1, 0, 2]^T$$

$$= [-2, 6, 2]^T - [1, 0, 2]^T$$

$$= [-3, 6, 0]^T$$

$$\text{new } w = [-3, 6, 0]^T$$

$$w^T x_5 = [-3, 6, 0]^T * [1, 0, 2]^T$$

$$= (-3 \times 1) + (6 \times 0) + (0 \times 2) = -3$$

$$= \text{sign}(-3) [\text{matches} - 1]$$

$$\text{Final } w = [-3, 6, 0]$$