Class Exercise on Perceptron Learning [Slide No: 14]

DATA

x_1 = "win the vote" = $\begin{bmatrix} \text{BIAS} : 1 \\ \text{win} : 1 \\ \text{game} : 0 \\ \text{vote} : 1 \\ \text{the} : 1 \end{bmatrix}$ $y^* = \text{Politics}$

x_2 = "win the election" = $\begin{bmatrix} \text{BIAS} : 1 \\ \text{win} : 1 \\ \text{game} : 0 \\ \text{vote} : 0 \\ \text{the} : 1 \end{bmatrix}$ $y^* = \text{Politics}.$

x_3 = "win the game" = $\begin{bmatrix} \text{BIAS} : 1 \\ \text{win} : 1 \\ \text{game} : 1 \\ \text{vote} : 0 \\ \text{the} : 1 \end{bmatrix}$ $y^* = \text{Sports}.$

LEARNING

For x_1

$w_{\text{SPORT}} \cdot x_1 = 1$

$w_{\text{POLITICS}} \cdot x_1 = 0 \quad \Rightarrow y = \text{SPORT} \quad y^* = \text{POLITICS}.$

$w_{\text{TECH}} \cdot x_1 = 0$

Update weights.

$w_{\text{SPORT}} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} - \begin{bmatrix} 1 \\ 1 \\ 0 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ -1 \\ 0 \\ -1 \\ -1 \end{bmatrix}$

$(w'_{\text{SPORT}} - y \cdot x = w_{\text{SPORT}})$

$w_{\text{POLITICS}} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \\ 0 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 0 \\ 1 \\ 1 \end{bmatrix}$ $(w'_{\text{POLITICS}} + x = w_{\text{POLITICS}})$

For x_2

$w_{SPORT} \cdot x_2 = -2$

$w_{POLITICS} \cdot x_2 = 3 \quad \Rightarrow y = POLITICS \ \& \ y^* = POLITICS.$

$w_{TECH} \cdot x_2 = 0$

No change to weights.

For x_3

$w_{SPORT} \cdot x_3 = -2$

$w_{POLITICS} \cdot x_3 = 3 \Rightarrow y = POLITICS \ \& \ y^* = SPORTS$

$w_{TECH} \cdot x_3 = 0$

Update weights

$$w_{SPORT} = \begin{bmatrix} 0 \\ -1 \\ 0 \\ -1 \\ -1 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ -1 \\ 0 \end{bmatrix}$$

$$w_{SPORT}' + x = w_{SPORT}$$

$$w_{POLITICS} = \begin{bmatrix} 1 \\ 1 \\ 0 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -1 \\ 1 \\ 0 \end{bmatrix}$$

$$w_{POLITICS}' - x = w_{POLITICS}$$