Eli Bakhi

Vectors + Perceptron WorkSheet

① $\vec{w} = [0.5, 0.5]$, $\|\vec{w}\| = \sqrt{.5^2 + .5^2} = \boxed{0.70710}$

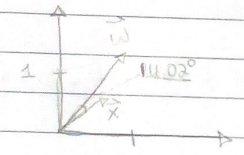
② $\vec{x} = [0.5, 0.5]$ $\vec{w} = [0.75, 1.25]$

$\vec{x} * \vec{w}^T = [0.5, 0.5] * \begin{bmatrix} 0.75 \\ 1.25 \end{bmatrix} = 0.5 \cdot .75 + 0.5 \cdot 1.25 = \boxed{1}$

③ $\vec{x}^T \cdot \vec{w} = \begin{bmatrix} .5 \\ .5 \end{bmatrix} * [.75, 1.25] = \boxed{\begin{bmatrix} .375 & .625 \\ .375 & .625 \end{bmatrix}}$

④ $\vec{x} \cdot \vec{w} = (0.5 \cdot .75) + (0.5 \cdot 1.25) = .375 + .625 = \boxed{1}$

⑤

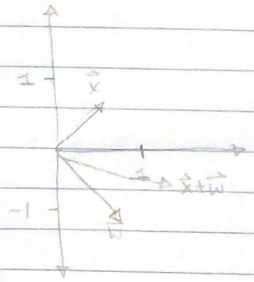


$\cos\theta = \frac{\vec{x} \cdot \vec{w}}{|x||w|} = \frac{1}{.7071 \cdot 1.4577} = \frac{1}{1.03073K7} = 0.9701770$

⑥ $\theta = 14.02°$ ⑦ $\theta = \cos^{-1}(0.9701770) = 14.02$

⑧ $\vec{x} = [0.5, 0.5]$ $\vec{w} = [0.75, -1]$

$\vec{x} + \vec{w} = [1.25, -0.5]$



⑨ Prediction involves estimating a continuous numerical value for a given input.

Classification involves assigning a categorical label for a given input. Classification involves discrete values

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(8) $w_0 = 0 \quad w_1 = 0.5 \quad w_2 = -0.5, \quad v = .25, \quad x_0 = 1$

x_1	x_2	OR
0	0	0
0	1	1
1	0	1
1	1	1

1st ROUND:

1st EXAMPLE: $\hat{y} = 1 \cdot 0 + 0.5 \cdot 0 + (-.5) \cdot 0 = 0$

$w_0 = w_0 - .25(0-0)(1)$

$w_1 = w_1 - .25(0-0)0$

$w_2 = w_2 - .25(0-0)0$

2nd Example: $\hat{y} = 1 \cdot 0 + .5 \cdot 0 + (-.5) \cdot 1 = -.5 \leq 0$ so $\hat{y} = 0$

$w_0 = w_0 - .25(0-1)(1) = .25$

$w_1 = w_1 - .25(0-1)(0) = .5$

$w_2 = w_2 - .25(0-1)(1) = -.25$

3rd Example $\hat{y} = .25 \cdot 1 + .5 \cdot 1 + (-.25) \cdot 0 = .75 > 0$ so $\hat{y} = 1$

- NO UPDATE

4th EXAMPLE $\hat{y} = .25 \cdot 1 + .5 \cdot 1 + (-.25) \cdot 1 = .5 > 0$ so $\hat{y} = 1$

- NO UPDATE

2nd ROUND:

1st Example $\hat{y} = .25 \cdot 1 + .5 \cdot 0 + -.25 \cdot 0 = .25 > 0$ so $\hat{y} = 1$

$w_0 = w_0 - .25(1-0)(1) = 0$

$w_1 = w_1 - .25(1-0)(0) = .5$

$w_2 = w_2 - .25(1-0)(0) = -.25$

2nd Ex: $\hat{y} = 0 \cdot 1 + .5(0) + (-.25)(1) = -.25$ so $\hat{y} = 0$

$w_0 = w_0 - .25(0-1)(1) = .25$

$w_1 = w_1 - .25(0-1)(0) = .5$

$w_2 = w_2 - .25(0-1)(1) = 0$

3rd Ex: $\hat{y} = .25 \cdot 1 + .5 \cdot 1 + 0 \cdot 0 = .75$ so $\hat{y} = 1$

NO CHANGE

4th Ex $\hat{y} = .25 \cdot 1 + .5 \cdot 1 + 0 \cdot 1 = .75$ so $\hat{y} = 1$

NO CHANGE

$W_0 = .25$ $W_1 = .5$ $W_2 = 0$

3RD ROUND

1st EX $\hat{y} = .25(1) + .5(0) + 0(0) = .25$ so $\hat{y} = 1$

$W_0 = W_0 - .25(1-0)(1) = 0$

$W_1 = W_1 - .25(1-0)(0) = .5$

$W_2 = W_2 - .25(1-0)(0) = 0$

2nd EX $\hat{y} = 0(1) + .5(0) + 0(1) = 0$ so $\hat{y} = 0$

$W_0 = W_0 - .25(0-1)(1) = .25$

$W_1 = W_1 - .25(0-1)(0) = .5$

$W_2 = W_2 - .25(0-1)(1) = .25$

3rd EX $\hat{y} = .25(1) + .5(1) + .25(0) = .75$ so $\hat{y} = 1$

NO CHANGE

4th EX $\hat{y} = .25(1) + (.5)(1) + .25(1) = 1$ so $\hat{y} = 1$ NO CHANGE

NO CHANGE

4TH ROUND

1st EX $\hat{y} = .25(1) + .5(0) + .25(0) = .25$ $\hat{y} = 1$

$W_0 = W_0 - .25(1-0)(1) = 0$

$W_1 = W_1 - .25(1-0)(0) = .5$

$W_2 = W_2 - .25(1-0)(0) = .25$

2nd EX $\hat{y} = 0(1) + .5(0) + .25(1) = .25$ $\hat{y} = 1$

NO CHANGE

3rd EX $\hat{y} = 0(1) + .5(1) + .25(0) = .5$ $\hat{y} = 1$

NO CHANGE

4th EX $\hat{y} = 0(1) + .5(1) + .25(1) = .75$ $\hat{y} = 1$

NO CHANGE

5TH ROUND

1st EX: $\hat{y} = 0(1) + .5(0) + .25(0) = 0$ $\hat{y} = 0$

NO CHANGE

2nd EX $\hat{y} = 0(1) + .5(0) + .25(1) = .25$ $\hat{y} = 1$ NO CHANGE

3rd EX $\hat{y} = 0(1) + .5(1) + .25(0) = .5$ $\hat{y} = 1$ NO CHANGE

4TH EX $\hat{y} = 0(1) + (.5)(1) + .25(1) = .75$ $\hat{y} = 1$ NO CHANGE

CONVERGED $\sqrt{}$ $W_0 = 0$ $W_1 = .5$ $W_2 = .25$