

$$1. \vec{w} = [0.5, 0.5]$$

$$|\vec{w}| = \sqrt{(0.5)^2 + (0.5)^2} = \sqrt{0.25 + 0.25} = \sqrt{0.5} \approx \boxed{0.7071}$$

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

$$\vec{x} \cdot \vec{w}^T =$$

$$\begin{aligned} [0.5, 0.5] \begin{bmatrix} 0.75 \\ 1.25 \end{bmatrix} &= [0.5 \cdot 0.75 + 0.5 \cdot 1.25] \\ \textcircled{1} \times 2 \quad 2 \times \textcircled{1} &= [0.375 + 0.625] \\ 1 \times 1 &\longrightarrow = \boxed{[1]} \end{aligned}$$

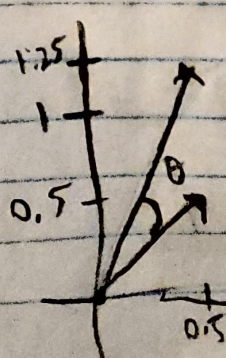
$$3. \vec{x}^T \cdot \vec{w}$$

$$\begin{aligned} \begin{bmatrix} 0.5 \\ 0.5 \end{bmatrix} [0.75, 1.25] &= \begin{bmatrix} 0.5 \cdot 0.75 & 0.5 \cdot 1.25 \\ 0.5 \cdot 0.75 & 0.5 \cdot 1.25 \end{bmatrix} \\ \textcircled{2} \times 1 \quad 1 \times \textcircled{2} & \\ 2 \times 2 &\longrightarrow = \boxed{\begin{bmatrix} 0.375 & 0.625 \\ 0.375 & 0.625 \end{bmatrix}} \end{aligned}$$

4.

$$\vec{x} \cdot \vec{w} = 0.5 \cdot 0.75 + 0.5 \cdot 1.25 = \boxed{1}$$

5.



$$\theta = \cos^{-1} \left[(\vec{x} \cdot \vec{w}) / (|\vec{x}| \cdot |\vec{w}|) \right]$$

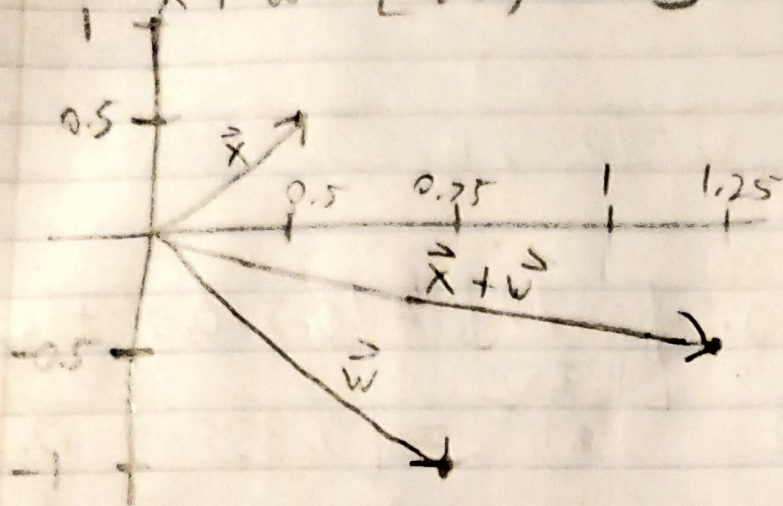
$$\theta = \cos^{-1} \left[1 / (\sqrt{0.5} \cdot \sqrt{2.125}) \right]$$

$$\boxed{\theta = 14.036^\circ}$$

$$|\vec{w}| = \sqrt{0.75^2 + 1.25^2} = \sqrt{2.125}$$

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

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



7.

Classification is used to categorize data based on similarities. Prediction is to predict values of new data using previously known data.

8. $w_0 = 0, w_1 = 0.5, w_2 = -0.5, lr = 0.25, x_0 = 1$

x_1	x_2	OR	y	Correct?
0	0	0	$(0 \cdot 0.5) + (0 \cdot -0.5) + 0 = 0$	✓
0	1	1	$(0 \cdot 0.5) + (1 \cdot -0.5) + 0 = -0.5$	X
1	0	1	$(1 \cdot 0.5) + (0 \cdot -0.5) + 0 = 0.5$	✓
1	1	1	$(1 \cdot 0.5) + (1 \cdot -0.5) + 0 = 0$	X

$w_1 = 0.5 - 0.25(-0.5 - 1) \cdot 0 = 0.5 \uparrow 0.75$

$w_2 = -0.5 - 0.25(-0.5 - 1) \cdot 1 = -0.125 \uparrow 0.125$

$w_0 = 0 - 0.25(-0.5 - 1) \cdot 1 = 0.375 \uparrow 0.625$

$$w_1 = 0.75, w_2 = 0.125, w_0 = 0.625$$

x_1	x_2	OR	y	Correct?
0	0	0	$0 + 0 + 0.625 = 0.625$	X
0	1	1	$0 + 0.125 + 0.625 = 0.75$	✓
1	0	1	$0.75 + 0 + 0.625 = 1.375$	✓
1	1	1	$0.75 + 0.125 + 0.625 = 1.5$	✓

$$w_1 = 0.75 - 0.25(0.625 - 0) \cdot 0 = 0.75$$

$$w_2 = 0.125 - 0.25(0.625 - 0) \cdot 0 = 0.125$$

$$w_0 = 0.625 - 0.25(0.625 - 0) \cdot 1 = 0.46875$$

$$w_1 = 0.75, w_2 = 0.125, w_0 = 0.46875$$

x_1	x_2	OR	y	Correct?
0	0	0	$0 + 0 + 0.46875 = 0.46875$	X
0	1	1	$0 + 0.125 + 0.46875 = 0.6$	✓
1	0	1	$0.75 + 0 + 0.46875 = 1.22$	✓
1	1	1	$0.75 + 0.125 + 0.46875 = 1.34$	✓

$$w_0 = 0.46875 - 0.25(0.46875 - 0) \cdot 1 = 0.3515625$$

x_1	x_2	OR	y	C?
0	0	0	$0 + 0 + 0.3515625 = 0.3515625$	X
0	1	1	$0 + 0.125 + 0.3515625 = 0.4765625$	✓
1	0	1	$0.75 + 0 + 0.3515625 = 1.1015625$	✓
1	1	1	$0.75 + 0.125 + 0.3515625 = 1.2265625$	✓

$$W_0 = 0.3515625 - 0.25(0.3515625 - 0) \cdot 1$$

$$= 0.263671875$$

x_1	x_2	OR	y	C?
0	0	0	$0 + 0 + 0.263671875 = 0.263671875$	X

$$W_0 = 0.263671875 - 0.25(0.263671875) \cdot 1$$

$$= 0.19775390625$$

repeat until $w_0 \leq 0$

$$W_0 = 0, W_1 = 0.75, W_2 = 0.125$$

x_1	x_2	OR	y	C?
0	0	0	$0 + 0 + 0 = 0$	✓
0	1	1	$0 + 0.125 + 0 = 0.125$	✓
1	0	1	$0.75 + 0 + 0 = 0.75$	✓
1	1	1	$0.75 + 0.125 + 0 = 0.875$	✓