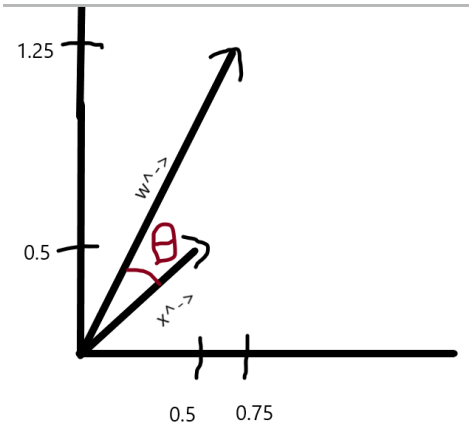
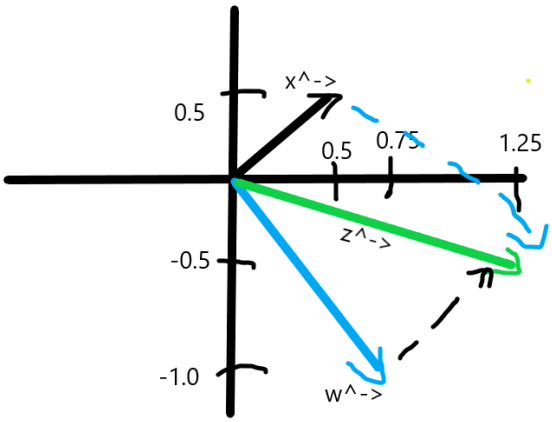
1. $|\vec{w}| = \sqrt{(0.5)^2 + (0.5)^2} = 0.707$
2. $\vec{x} * \vec{w}^T = x_1 w_1 + x_2 w_2 = (0.5)(0.75) + (0.5)(1.25) = 1$
3. $\vec{x}^T * \vec{w} = x_1 w_1 + x_2 w_2 = (0.5)(0.75) + (0.5)(1.25) = 1$
4. $\vec{x} \bullet \vec{w} = x_1 w_1 + x_2 w_2 = (0.5)(0.75) + (0.5)(1.25) = 1$
5. $\vec{x} \bullet \vec{w} = x_1 w_1 + x_2 w_2 = |\vec{x}| * |\vec{w}| * cos(\theta) \rightarrow cos(\theta) = (x_1 w_1 + x_2 w_2)/(|\vec{x}| * |\vec{w}|)$
   $= 1/(0.707 * \sqrt{0.75^2 + 1.25^2}) = 0.970 \rightarrow \theta = cos^{-1}(0.970) = 0.244\, rad = 14°$



6. $\vec{z} = \vec{x} + \vec{w} = [x_1 + w_1, x_2 + w_2] = [0.5 + 0.75,\ 0.5 - 1] = [1.25, -0.5]$



7. Prediction involves using existing outputs to make an estimate of future outputs. Classification involves identifying existing outputs with a particular category of results.
8. Initial weights: $w_0 = 0$, $w_1 = 0.5$, $w_2 = -0.5$, $lr = 0.25$. Assume $x_0 = 1$ for all passes.
   First pass: $x_1 = 0$, $x_2 = 0$, $OR = 0$
   $y = g(w_0x_0 + w_1x_1 + w_2x_2) = g[(0)(1) + (0.5)(1) + (-0.5)(1)] = 0$ -> correct
   Due to being correct, no adjustments to weights

Second pass: $x_1 = 0$, $x_2 = 1$, $OR = 1$

$y = g(w_0x_0 + w_1x_1 + w_2x_2) = g[(0)(1) + (0.5)(0) + (-0.5)(1)] = -0.5$ -> incorrect

Weight adjustments: $w_{ij} <- w_{ij} - g(y_j - OR_j)x_i$

$w_0 = 0 - g[\ (-0.5) - (1)\ ](1) = 1.5$

$w_1 = 0.5 - g[\ (-0.5) - (1)\ ](0) = 0.5$

$w_2 = -0.5 - g[\ (-0.5) - (1)\ ](1) = 1$

Third pass: $x_1 = 1$, $x_2 = 0$, $OR = 1$

$y = g(w_0x_0 + w_1x_1 + w_2x_2) = g[(1.5)(1) + (0.5)(1) + (1)(0)] = 2$ -> incorrect

Weight adjustments: $w_{ij} <- w_{ij} - g(y_j - OR_j)x_i$

$w_0 = 1.5 - g[\ (0.5) - (1)\ ](1) = 2$

$w_1 = 0.5 - g[\ (0.5) - (1)\ ](1) = 1$

$w_2 = 1 - g[\ (0.5) - (1)\ ](0) = 1$

Fourth pass: $x_1 = 1$, $x_2 = 1$, $OR = 1$

$y = g(w_0x_0 + w_1x_1 + w_2x_2) = g[(2)(1) + (1)(1) + (1)(1)] = 4$ -> incorrect

Weight adjustments: $w_{ij} <- w_{ij} - g(y_j - OR_j)x_i$

$w_0 = 2 - g[\ (4) - (1)\ ](1) = -1$

$w_1 = 1 - g[\ (4) - (1)\ ](1) = -2$

$w_2 = 1 - g[\ (4) - (1)\ ](1) = -2$