Logistic Regression

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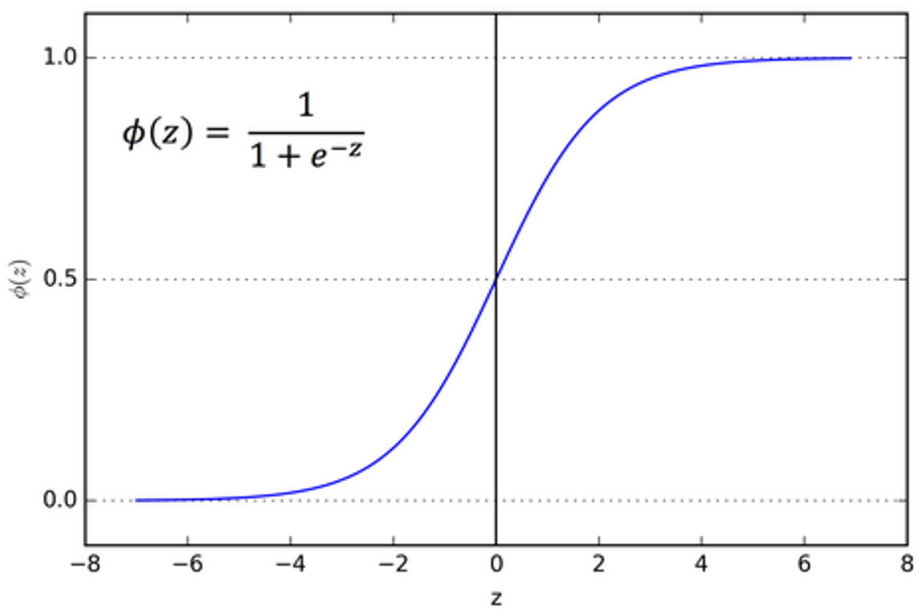
Sigmoid Function

$$g(z) = \frac{1}{(1 + e^{-z})}$$



$$\hat{y} = g\left(\sum w_i \cdot x_i\right) = g(z)$$

Derivative of sigmoid

$$g'(z) = g(z) * 1(- g(z))$$

Logistic Regression

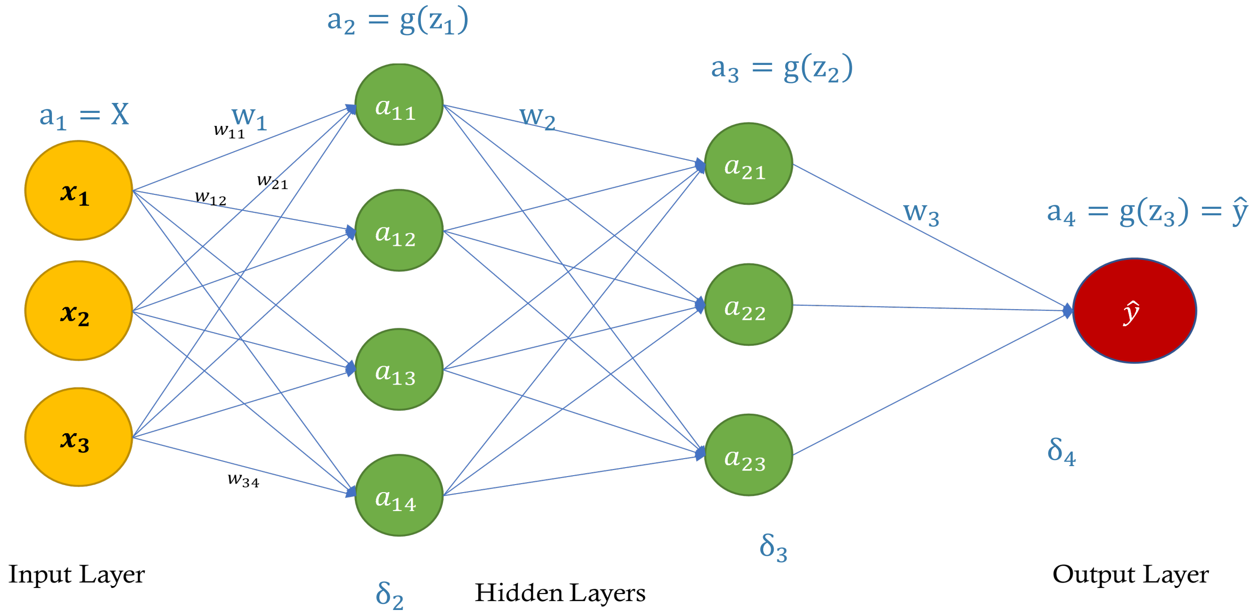
$$\mathbf{P(Y|X)} = \hat{\mathbf{y}}^{\mathbf{y}}(\mathbf{1} - \hat{\mathbf{y}})^{(\mathbf{1}-\mathbf{y})} \qquad \textit{Probability of y given x}$$

Cost Function for Logistic Regression

$$C = -\Sigma\, y \log(\hat{y}) + (1 - y)\log(1 - \hat{y})$$

$$\frac{dC}{dw} = (\hat{y} - y)x$$

Multilayer Neural Network and Back Propagation



Multilayer Perceptron

<u>Forward Propagation</u>

$a_1 = x_i$

$z_1 = \sum w_{1*} x_i$

$a_2 = g(z_1)$

$z_2 = \sum w_2 * a_2$

$a_3 = g(z_2)$

$z_3 = \sum w_3 * a_3$

$a_4 = g(z_3) = \hat{y}$

<u>Backward Propagation</u>

$\delta_4 = (\hat{y} - y)$

$$\frac{\partial c}{\partial \omega_3} = a_3 \delta_4$$

$\delta_3 = (w_3 \delta_4) * g'(z_3)$

$$\frac{\partial c}{\partial \omega_2} = a_2 \delta_3$$

$\delta_2 = (w_2 \delta_3) * g'(z_2)$

$$\frac{\partial c}{\partial \omega_1} = a_1 \delta_2$$

we know that

$g'(z) = g(z) * 1(- g(z))$

And Finally

$$w_i = w_i - \lambda \frac{\partial C}{\partial w_i}$$ ***where λ is learning Rate.***