

Logistic Regression: Vectorizing Logistic Regression

The *Sigmoid Function* of $\frac{1}{1+e^{-z}}$ is used when computing the hypothesis for logistic regression which means that the normal vectorized compute of $\theta^T X$ is not going to work in this case since the *Sigmoid Function* would not be applied. Using vector math this can be achieved using the following:

$$\vec{Z} = w^T X + \vec{b}$$

Where

$$X = \begin{bmatrix} x_1^{(1)} & x_2^{(1)} & x_3^{(1)} & x_n^{(1)} \\ x_1^{(2)} & x_2^{(2)} & x_3^{(2)} & x_n^{(2)} \\ x_1^{(3)} & x_2^{(3)} & x_3^{(3)} & x_n^{(3)} \end{bmatrix}$$

$$w^T = [\theta_1 \quad \theta_2 \quad \theta_3 \quad \theta_n]$$

$$\vec{b} = [\theta_0 \quad \theta_0 \quad \theta_0 \quad \dots]$$

From there we can take \vec{Z} and pass to our Sigmoid Function:

$$h_{\theta}(x) = S(\vec{Z})$$