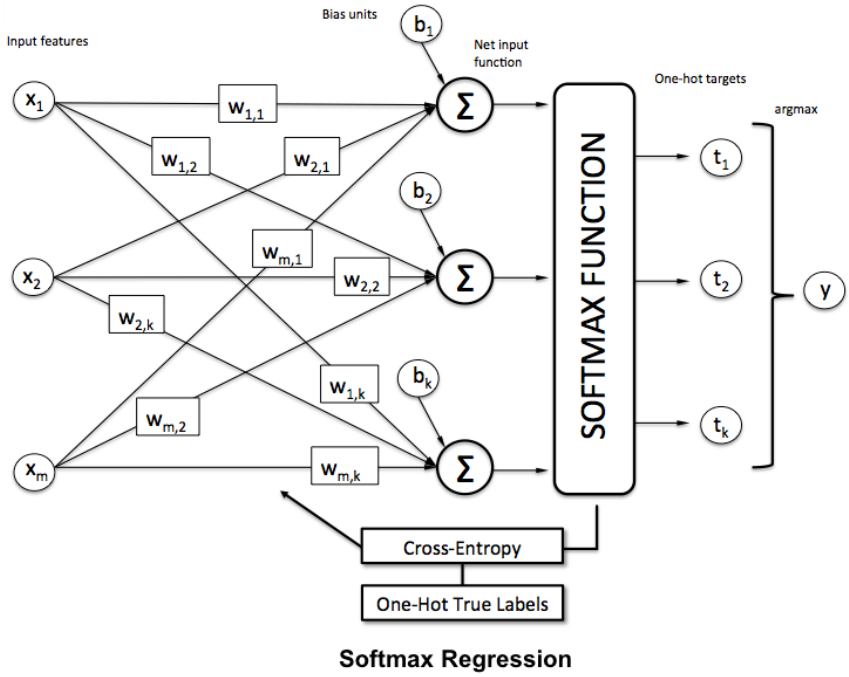
Consider the Softmax Regression architecture.



(a). Given a two-dimensional dataset with three classes (m=2, k=3), write the expression for the outputs of the summing junctions z_1, z_2 and z_3

$$z_1 = b_1 + w_{11}x_1 + w_{21}x_2$$

$$z_2 = b_2 + w_{12}x_1 + w_{22}x_2$$

$$z_3 = b_3 + w_{13}x_1 + w_{23}x_2$$

(b). Suppose the values of the weight parameters are:

$$w_{11} = 0.1, w_{12} = 0.2, w_{13} = 0.3$$

$$w_{21} = 0.1, w_{22} = 0.2, w_{23} = 0.3$$

$$b_1 = 0.01, b_2 = 0.1, b_3 = 0.1$$

What is the class label that will be assigned by the classifier for the test instance $x = \begin{bmatrix} 0.1 \\ 0.5 \end{bmatrix}$

Hint: find $p(y = j|z_j) = \frac{\exp(z_j)}{\sum_{i=1}^{k} \exp(z_i)}$

$$z_1 = 0.07,\ z_2 = 0.22, z_3 = 0.28$$

$$p(y = 1|z_1) = \frac{\exp(0.07)}{\exp(0.07)+\exp(0.22)+\exp(0.28)} = 0.2945$$

$$p(y = 2|z_2) = \frac{\exp(0.22)}{\exp(0.07)+\exp(0.22)+\exp(0.28)} = 0.3422$$

$$p(y = 3|z_3) = \frac{\exp(0.28)}{\exp(0.07)+\exp(0.22)+\exp(0.28)} = 0.3633$$

$$Max(p(y = 1|z_1), p(y = 2|z_2), p(y = 3|z_3)\ ) \rightarrow Class\ 3$$