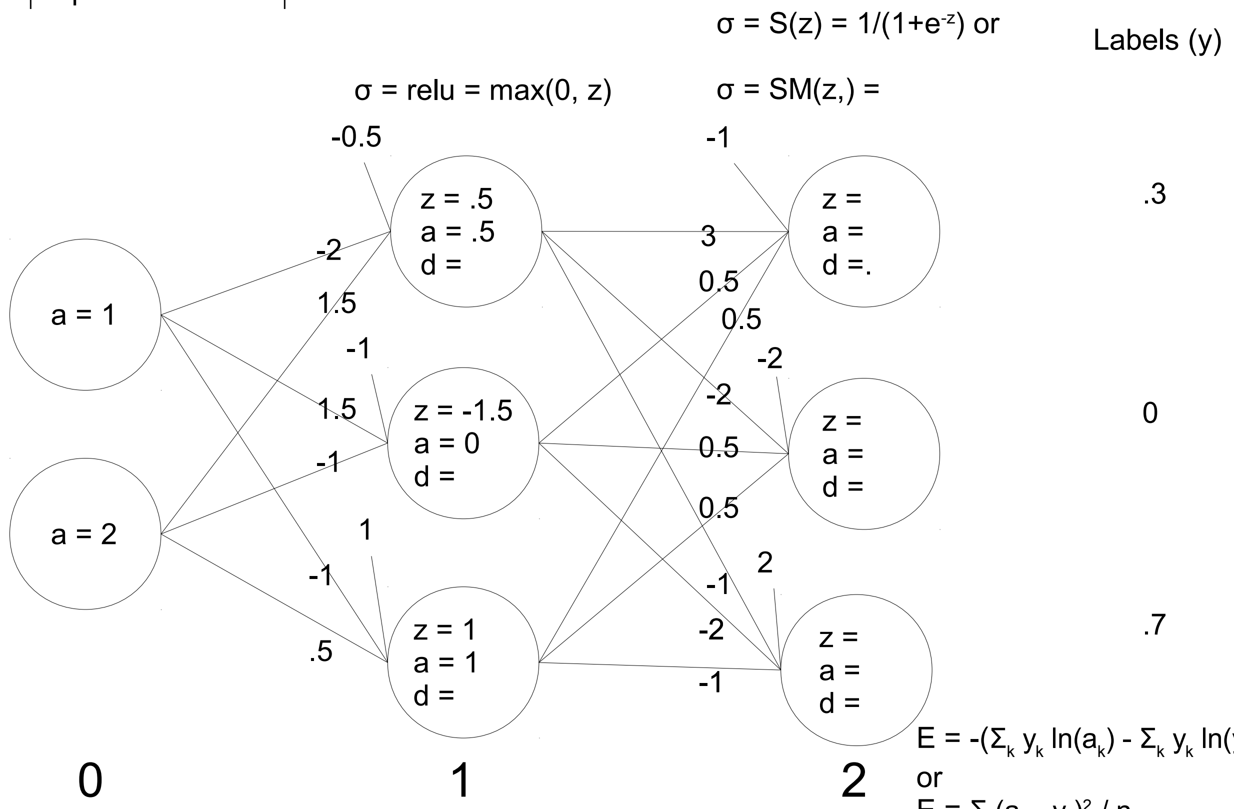
Notation:

n^L = number of neurons in layer L. n^0 is number of inputs
w_{ij}^L = weight into layer L, from neuron j to neuron i
W^L = matrix of weights from L-1 to L, dimension 2
b_i^L = bias for neuron i of layer L
B^L = bias vector for layer L
a_i^L = output i of layer L.
A^L = vector output of layer L. A^0 is input vector
z_i^L = weighted sum of neuron i of layer L incl bias.
σ = activation function. $a_i^L = \sigma(z_i^L)$, or sometimes, $a_i^L = \sigma(Z^L)$ e.g. for softmax
E = error function cost = $E(A^N, Y)$, where N is final layer
d_i^L = partial of E wrt z_i^L



$E = -(\Sigma_k\, y_k \ln(a_k) - \Sigma_k\, y_k \ln(y_k))$
or
$E = \Sigma_k (a_k - y_k)^2 / n$

For all w_{ij}:

$\partial E / \partial w_{ij}^x = a_j^{x-1}\, \partial E/\partial z_i^x$

$\partial E/\partial z_i^1 = \partial a_i^1/\partial z_i^1 * \Sigma_k(\partial z_k^2/\partial a_i^1 * \partial E/\partial z_k^2)$
$= \partial a_i^1/\partial z_i^1 * \Sigma_k(w_{ki}^2 * \partial E/\partial z_k^2)$

$\partial E/\partial z_j = \partial a_j/\partial z_j * \partial E/\partial a_j$

$\partial E/\partial a_j = -y_j / a_j$

For S(z) activation:

$\partial a/\partial z = e^{-z}/(1+e^{-z})^2$

More complex for softmax, where da/dz becomes a matrix of da_j/dz_i for all j, i:

$\partial a_j/\partial z_i$ = for i=j: $a_j(1-a_i)$, for i<>j: $a_j(0-a_i)$
or just $\partial a_j/\partial z_i = \Sigma_j\, a_j(\delta_{ij} - a_i)$

$$\begin{vmatrix} \partial E/\partial z_1 \\ \partial E/\partial z_2 \\ \partial E/\partial z_3 \end{vmatrix} = \begin{vmatrix} \partial a_1/\partial z_1 & \partial a_2/\partial z_1 & \partial a_3/\partial z_1 \\ \partial a_1/\partial z_2 & \partial a_2/\partial z_2 & \partial a_3/\partial z_2 \\ \partial a_1/\partial z_3 & \partial a_2/\partial z_3 & \partial a_3/\partial z_3 \end{vmatrix} \begin{vmatrix} \partial E/\partial a_1 \\ \partial E/\partial a_2 \\ \partial E/\partial a_3 \end{vmatrix}$$