Homework2

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1.1

$$\frac{\delta E}{\delta w_1} = \sum_{XEX}(out_x - o_x)\frac{\delta}{\delta w_1}(out_x - (w_0 + w_1 x_1 + w_1 x_{1x}^2 + ... + w_n x_n + w_n x_x^2))$$

$$\frac{\delta E}{\delta w_1}(out_x - o_x)(-x_{ix} - x_{ix}^2)$$

1.2

a.
Input at neuron 1 = x1
Input at neuron 2= x2
Output at neuron 1=f(x1) =x1
Output at neuron 2=f(x2) =x2

Input at neuron 3 = w31.x1 +w32.x2
Input at neuron 4= w41.x1 +w42.x2
Output at neuron 3=h(w31.x1 +w32.x2)
Output at neuron 4=h(w41.x1 +w42.x2)

Input at neuron 5 = w53 *(output of neuron 3) +w54 *(output of neuron 4) = w53. h(w31.x1 +w32.x2) + w54. h(w41.x1 +w42.x2)
Output at neuron 5= h(w53. h(w31.x1 +w32.x2) + w54. h(w41.x1 +w42.x2)) =y5

y5= h(w53. h(w31.x1 +w32.x2) + w54. h(w41.x1 +w42.x2))

b.
Input Layer:
Output of input layer = f(X) = X[Dimensions=2*1]

Hidden Layer:
Input of hidden layer = W[1].X [Dimensions = 2*2 * 2*1 = 2*1]
Output of hidden layer = h(W[1].X) [Dimensions = 2*1]

Output Layer:
Input at output layer = (W[2].h)(h(W[1].X)[Dimensions = 1*2 * 2*1 =1*1]
Output of output layer = h(W[2].h)(h(W[1].X))[Dimensions =1*1]

y5 = h(W[2].h)(h(W[1].X)) in terms of vector X, W[1] and W[2] .

C.
First, let's compute the relationship between the sigmoid function hs(x) and the tangent function ht(x):

$$hs(x) = 1/(1 + e^{(-x)})$$
$$ht(x) = (e^x - e^{(-x)})/(e^x + e^{(-x)})$$

$$y5_{sigmoid} = hs(w53 * hs(w31 * x1 + w32 * x2) + w54 * hs(w41 * x1 + w42 * x2))$$

$$y5_{tanh} = ht(w53 * ht(w31 * x1 + w32 * x2) + w54 * ht(w41 * x1 + w42 * x2))$$

Now we will substitute ht(x) with the expression we found in terms of hs(x):

$$y5_{tanh} = \frac{(1 - hs(-(w53 * ht(w31 * x1 + w32 * x2) + w54 * ht(w41 * x1 + w42 * x2))))}{(1 + hs(-(w53 * ht(w31 * x1 + w32 * x2) + w54 * ht(w41 * x1 + w42 * x2))))}$$

We can see that these two functions are related, with the parameters differing only by linear transformations and constants.