

Homework: Feedforward Neural Networks

1. Show that, if

$$\sigma(x) = \frac{1}{1 + e^{-x}}$$

then $\sigma'(x) = \sigma(x)(1 - \sigma(x))$

2. Given the network with one node in the input layer, one node in the hidden layer, and one node in the output layer,
- (a) Write the function (using the standard sigmoidal) that this function represents.
 - (b) Compute the partial derivatives of the error (given one pattern, target pair) of all the parameters. Write them directly- No need to use the formulas from class.
3. Verify that your answers to the previous problem match up to how we did them in general for the backpropagation algorithm.
4. Here are the parameters for a certain $1 - 2 - 1$ network:
- The initial weights are 0.2 and -0.1 (for top and bottom hidden node, resp.).
 - The biases at the hidden node are 1 and 0. The transfer function is the basic sigmoidal (exponential).
 - The second set of weights are -0.1 and 0.2, (for top and bottom, resp).
 - The final bias is 1.

- (a) Put these in terms of the notation from class-

$$f(x) = W_2\sigma(W_1x + b_1) + b_2$$

What is W_1 , W_2 , b_1 , b_2 (keep track of dimensions of things).

- (b) If the input value is 1, compute the output value.
- (c) Compute all the δ 's for each node, if the desired target value was 1.5.
- (d) Compute the changes in W_1, W_2, b_1, b_2 .