Training Neural Networks

CS 129.18 Quiz

November 9, 2017

Abstract

Answer the following problems by performing feed forward and backpropagation twice for training and a final feed forward using the trained weights (i.e. Feed forward and backprop, Feed forward and backprop and another feed forward using the final weights). For the starting weights, use random numbers from 0 to 0.99 (you can use excel's rand() for this). Submit your solutions and make sure they indicate the starting weights for each problem as well the numbers generated for Z neurons and change in weights ΔW and the change in errors $E = [e_1, e_2, e_3, ...]$ for each iteration.

1 Problem A

Given the following:

1. Topology: $[3, 2, 3, 2]$
2. Input: $[1, 0, 1]$
3. Output: $[1, 0]$
4. Cost Function: $(y - \widehat{y})^2$
5. Activation Scheme: Relu, Relu, Sigmoid
6. Weights:

$$W_1 = \begin{bmatrix} w_i & w_i \\ w_i & w_i \\ w_i & w_i \end{bmatrix} W_2 = \begin{bmatrix} w_i & w_i & w_i \\ w_i & w_i & w_i \end{bmatrix} W_3 = \begin{bmatrix} w_i & w_i \\ w_i & w_i \\ w_i & w_i \end{bmatrix} \tag{1}$$

2 Problem B

Given the following:

1. Topology: $[5, 4, 3, 2]$
2. Input: $[1, 0, 0.8, 0.9, 0.8]$
3. Output: $[1, 0]$
4. Cost Function: $(y - \widehat{y})^2$
5. Activation Scheme: Sigmoid, Sigmoid, Sigmoid
6. Weights:

$$W_1 = \begin{bmatrix} i_i & i_i & i_i & i_i \\ i_i & i_i & i_i & i_i \\ i_i & i_i & i_i & i_i \\ i_i & i_i & i_i & i_i \\ i_i & i_i & i_i & i_i \end{bmatrix} W_2 = \begin{bmatrix} w_i & w_i & w_i \\ w_i & w_i & w_i \\ w_i & w_i & w_i \\ w_i & w_i & w_i \end{bmatrix} W_3 = \begin{bmatrix} w_i & w_i \\ w_i & w_i \\ w_i & w_i \end{bmatrix} \tag{2}$$

3 Problem C

Given the following:

1. Topology: $[5, 3, 2, 3, 5]$
2. Input: $[0.9, 0.8, 0.9, 0.2, 0.3]$
3. Output: $[0.9, 0.8, 0.9, 0.2, 0.3]$
4. Cost Function: $(y - \widehat{y})^2$
5. Activation Scheme: Relu, Relu, Relu, Relu
6. Weights:

$$W_1 = \begin{bmatrix} w_i & w_i & w_i \\ w_i & w_i & w_i \\ w_i & w_i & w_i \\ w_i & w_i & w_i \\ w_i & w_i & w_i \end{bmatrix} W_2 = \begin{bmatrix} w_i & w_i \\ w_i & w_i \\ w_i & w_i \end{bmatrix} W_3 = \begin{bmatrix} w_i & w_i & w_i \\ w_i & w_i & w_i \end{bmatrix} W_4 = \begin{bmatrix} w_i & w_i & w_i & w_i & w_i \\ w_i & w_i & w_i & w_i & w_i \\ w_i & w_i & w_i & w_i & w_i \end{bmatrix} \quad (3)$$