EEL4930/EEL5840 Fall 2016 – Homework 6
Multi-Layer Neural Networks

November 17, 2016

Due: November 25, 2016, 11:59 PM

Instructions

For this homework, please show any plots and tables. Label your plots' axes and include plot titles. As well, state all assumptions that you made. For this assignment, include your code. You should program the solutions yourself.

Remember that commenting your results is very important. It is expected of you to systematically discuss your results. If no explanation is given, your grade will be penalized.

Your homework submission must cite any references used, including articles, books, code, websites, and personal communications). All solutions must be written in your own words, and you should program the algorithms yourself. If you do work with others, you must list the people you worked with. Submit your solutions as a single PDF file to the course website at http://elearning.ufl.edu/.

If you have any questions, then address them to:

- Catia Silva (TA) – catiaspsilva@ufl.edu
- Isaac Sledge (TA) – isledge@ufl.edu

Problems

In this homework, you will need to perform the following tasks:

1) (10 points) Code the backpropagation algorithm for neural networks. Include your code with the homework solution. Test your implementation on the following two-class dataset:

x_1	x_2	d
1	0	1
0	1	1
-1	0	1
0	-1	1
0.5	0.5	0
-0.5	0.5	0
0.5	-0.5	0
-0.5	-0.5	0

From this table, you can see that samples which are close to the x_1 and x_2 axes belong to one class. All of the others belong to the second class.

We expect that an appropriately sized neural network will learn this pattern exactly. Make sure to note the size of the network that you used and explain why you used that number of hidden processing elements. Plot the corresponding decision boundaries after the networks have finished training. As well, see how well your solution performs on samples that do not belong to the training set by generating additional samples that follow the same pattern. Keep these generated points within a square that has length 2 on each of its sides.

Lastly, explain what solution you would chooose if you were going to hand-select the parameters of the network. Does the multi-layer neural network learn the solution that you expected? How would you improve the generalization accuracy of the multi-layer neural network?