

CAP 5638: Assignment #3

Due on Wednesday, Oct 7, 2015

XiuWen Liu 10:10am

Jian Wang

Contents

| | |
|-----------|---|
| Problem 1 | 3 |
| Problem 2 | 3 |

Problem 1

Problem 5 (15 points) Computer Exercise 1 of Chapter 6 of the textbook

1. Consider a 2-2-1 network with bias, where the transfer function at the hidden units and the output unit is a sigmoid $y_j = a \tanh[b \text{net}_j]$ for $a = 1.716$ and $b = 2/3$.

- (a) Suppose the matrices describing the input-to-hidden weights (w_{ji} for $j = 1, 2$ and $i = 0, 1, 2$) and the hidden-to-output weights (w_{kj} for $k = 1$ and $j = 0, 1, 2$) are, respectively,

$$\begin{pmatrix} 0.5 & -0.5 \\ 0.3 & -0.4 \\ -0.1 & 1.0 \end{pmatrix} \text{ and } \begin{pmatrix} 1.0 \\ -2.0 \\ 0.5 \end{pmatrix}.$$

The network is to be used to classify patterns into one of two categories, based on the sign of the output unit signal. Shade a two-dimensional input space $x_1 - x_2$ ($-5 \leq x_1, x_2 \leq +5$) black or white according to the category given by the network. Repeat with

- (b) Repeat part (a) but with the following weight matrices:

$$\begin{pmatrix} -1.0 & 1.0 \\ -0.5 & 1.5 \\ 1.5 & -0.5 \end{pmatrix} \text{ and } \begin{pmatrix} 0.5 \\ -1.0 \\ 1.0 \end{pmatrix}.$$

Answer:

Problem 2

Problem 6 (15 points) Computer Exercise 5 of Chapter 6 of the textbook

5. Write a basic backpropagation program for a 3-3-1 network with bias to solve the three-bit parity problem, i.e., return a +1 if the number of input units that are high is even, and -1 if odd.

- Show the input-to-hidden weights and analyze the function of each hidden unit.
- Retrain several times from a new random point until you get a local (but not global) minimum. Analyze the function of the hidden units now.
- How many patterns are properly classified for your local minimum? Explain.

Answer: