INT301 Bio-computation

Week 3 Tutorial

Question 1

The following two Boolean functions take two Boolean features x_1 and x_2. The features can take on the values −1 and +1, where −1 represents False and +1 represents True. The output y of the functions can also take on the values −1 and +1, with the same interpretation. For each of the functions below, either give weights for a perceptron such that the perceptron represents the function or argue that no such weights exist.

1) $y = \begin{cases} +1, & if\ x_1 = x_2 \\ -1, & otherwise \end{cases}$

2) $y = \begin{cases} +1, & if\ x_1 = 1\ and\ x_2 = -1 \\ -1, & otherwise \end{cases}$

Question 2

You want to design a neural network with sigmoid units to predict a person's academic role from his webpage. Possible roles are "professor", "student", and "staff". However, each person can take any number (from 0 to all 3) of these roles at the same time. Briefly describe:

(1) How you would represent the role label of a person in your training data.

(2) Suggest a possible threshold value for the outputs.

Question 3

Consider the following Boolean function:

A	B	$\neg A \vee B$
1	1	1
1	0	0
0	1	1
0	0	1

Construct a perceptron that represents the function.

Question 4

Consider a task involving "a three-input, one-output parity detector" which outputs a 1 if the number of "1" inputs is even; otherwise it outputs a 0. Can this function be represented by a perceptron? Explain.