CSE 5526 - Autumn 2014

Introduction to Neural Networks

Homework #1

Due Tuesday, Sept. 9

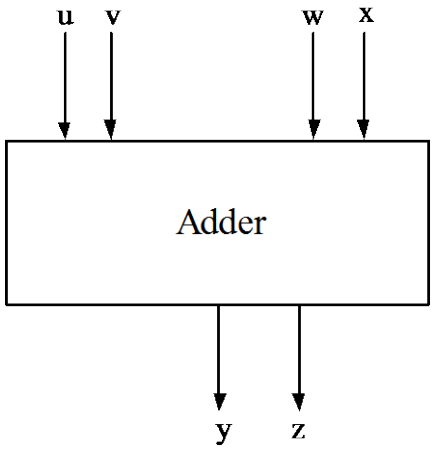
Grader: Yuzhou Liu
Email: liu.2376@osu.edu
Office: Dreese Labs 578
Office hours: Monday & Wednesday 3 - 4pm

Problem 1. Give weights and bias for a McCulloch-Pitts (M-P) neuron with inputs $x, y, z \in \{-1,1\}$ and whose output is z if x = -1 and y = 1, and is -1 otherwise.

Problem 2. For this problem, change the definition of an M-P neuron so that both its inputs and output are binary (i.e., either 0 or 1 instead of -1 or 1). View *uv*, *wx* as two-bit binary numbers, and *yz* as the 2 low-order bits of the numerical addition of *uv* and *wx*.

(a) Give weights and biases for an M-P network which generates *z*.

(b) Give weights and bias for an M-P network which generates *y*.



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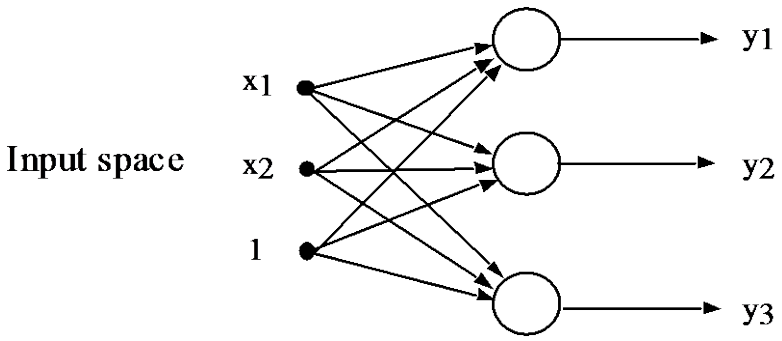
Problem 3. Give the following 3-class classification problem:

C_1: {(4, 1), (2, 3), (3, 5), (5, 4), (1, 6)}
C_2: {(0, 2), (-2, 2), (-3, 2), (-2, 4)}
C_3: {(1, -2), (3, -2)}

and the following M-P network:



(a) Can the net learn to separate the samples, given that you want: if $\mathbf{x} \in C_i$ then $y_i = 1$ and $y_j = -1$ for $j \neq i$. No need to solve for the weights, but justify your answer.

(b) Add the sample (-1, 6) to C_1. Repeat part (a).