

Assignment #7

ECE 449, Intelligent Systems Engineering
Department of Electrical and Computer Engineering, University of Alberta

No late assignments accepted!

Fall 2019
Dr. Petr Musilek

Points: 10

Due: Thursday, November 7, 2019, 3:30 PM,
in the assignment box in the ETLC atrium

Note: Show your work! Marks are allocated
for technique and not just the answer.

Student Name:

ID Number:

1. [10 points] Consider a neural network with two inputs and three neurons in the competitive layer. The input vectors in the training set have the values

$$x_1 = \begin{bmatrix} -1 \\ 0 \end{bmatrix}, x_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, x_3 = \begin{bmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix},$$

and the initial weight vectors are

$$w_1 = \begin{bmatrix} 0 \\ -1 \end{bmatrix}, w_2 = \begin{bmatrix} -2/\sqrt{5} \\ 1/\sqrt{5} \end{bmatrix}, w_3 = \begin{bmatrix} -1/\sqrt{5} \\ 2/\sqrt{5} \end{bmatrix}.$$

- Plot the input vectors and initial weights on a unit circle.
- Calculate the resulting weights found after training the neurons with competitive learning rule using learning rate $\alpha=0.5$, on the following sequence of inputs: $x_1, x_2, x_3, x_1, x_2, x_3$. Note: Weights must always lie on a unit circle, and thus must be re-normalized after each iteration.
- Analyze the resulting weights and elaborate on the final weight distribution with respect to the input vectors.