Ain Shams University, Faculty of Engineering,
Computer & Systems Engineering Department
CSE463: Neural Networks
Sheet #05: MACHINE LEARNING WITH SHALLOW NEURAL NETWORKS

1- Using a batch training, write a pseudocode algorithm for training a shallow neural network that has three output nodes using the perceptron criterion. You must clarify the inputs and outputs as well as the data structures used in your code.
2- Using a batch training, write a pseudocode algorithm for training a shallow neural network that has three output nodes using the SVM criterion. You must clarify the inputs and outputs as well as the data structures used in your code.
3- Using a batch training, write a pseudocode algorithm for training a shallow neural network that has three output nodes using the multinomial regression criterion. You must clarify the inputs and outputs as well as the data structures used in your code.
4- Write a pseudocode algorithm to normalize training data as explained in the course lectures.
5- Derive and visualize the classification boundary for the following given data sets using a shallow neural network:-

$$D = \{([0,0]^T, 1), ([0,1]^T, 1), ([1,0]^T, 1), ([2,0]^T, 2), ([2,1]^T, 2), ([3,0]^T, 2), ([0,3]^T, 3), ([0,4]^T, 3), ([1,3]^T, 3)\};$$

6- Derive and visualize the classification boundary for the following given data sets using a shallow neural network:-

$$D = \{([x1, y1]^T, 1), ([x1+a, y1]^T, 1), ([x1-a, y1]^T, 1), ([x1, y1+a]^T, 1), ([x1, y1-a]^T, 1), ([x2, y2]^T, 2), ([x2+a, y2]^T, 2), ([x2-a, y2]^T, 2), ([x2, y2+a]^T, 2), ([x2, y2-a]^T, 2), ([x3, y3]^T, 3), ([x3+a, y3]^T, 3), ([x3-a, y3]^T, 3), ([x3, y3+a]^T, 3), ([x3, y3-a]^T, 3), ([x4, y4]^T, 4), ([x4+a, y4]^T, 4), ([x4-a, y4]^T, 4), ([x4, y4+a]^T, 4), ([x4, y4-a]^T, 4)\}; \text{ where } (x1, y1) = (3, 0) \ \& \ (x2, y2) = (-3, 0) \ \& \ (x3, y3) = (0, 3) \ \& \ (x4, y4) = (0, -3) \ \& \ a = 1.$$

7- Repeat the problems of 5 and 6 using the SVM GD criterion.
8- Repeat the problems of 5 and 6 using the multinomial logistic regression GD criterion.