ENGG 5202: Homework #4

Due on Thursday, April 21, 2016, 5:30pm

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Problem 1

[**30 points**]

Design a three layer neural network whose decision boundary is as shown in Figure 1. The gray region belongs to class 1 and other region belongs to class 0. Show your network structure, weights and nonlinear activation function.

Problem 2

[**30 points**]

A three-layer neural network is shown in Figure 2. Suppose the network is to be trained with the objective function

$$J = \frac{1}{4} \sum_{k=1}^{c} (t_k - z_k)^4.$$

Derive the learning rule Δw_{kj} for the hidden-to-output weights.

Problem 3

[**40 points**]

Consider a d-n_H-c network trained with n training samples

- What is the space complexity in this problem? (Consider both the storage of network parameters as well as the storage of training samples, but not the program itself.)
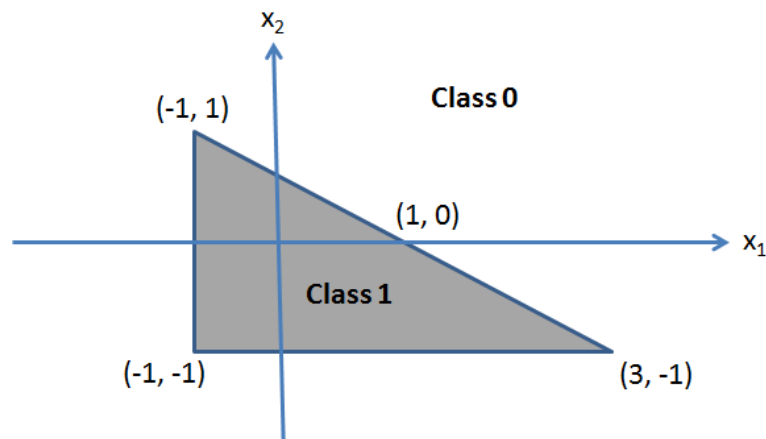
Figure 1:

$z_k = f(net_k)$

$net_k = \sum_{i=1}^{n_H} y_j w_{kj} + w_{k0}$

$y_j = f(net_j)$

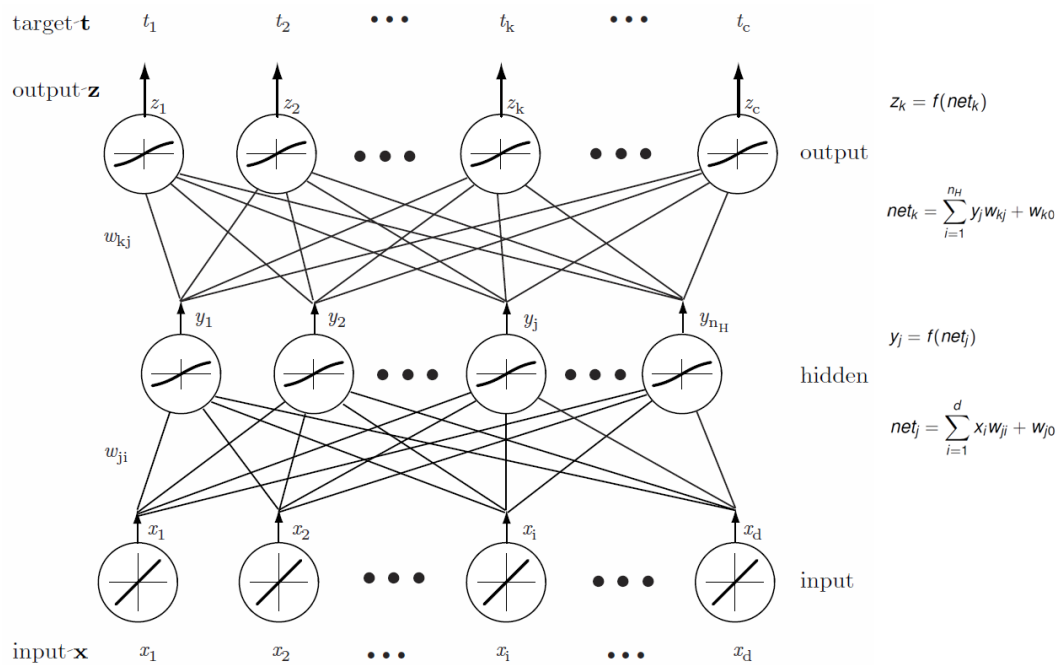$net_j = \sum_{i=1}^{d} x_i w_{ji} + w_{j0}$

Figure 2:

- Suppose the network is trained in stochastic mode. What is the time complexity for each update iteration? Because this is dominated by the number of multiply-accumulates, use this as a measure of the time complexity.

- Suppose the network is trained in a batch mode. What is the time complexity for each update iteration?