SCE301 Bio-computation Week 4 Lab Exercises, 2016

Multi-layer Perceptrons (MLP)

Prepared by Bailing Zhang

A Real-world Pattern Classification Problem

The task of this exercise is to build a multilayer feedforward network MLP for the recognition of noisy car logo images, which are segmented from some vehicle images captured by surveillance cameras. You are provided with a collection of binary logo images given as 15x15 black- white pixel maps. Ideally, the trained network can recognize the logos it has learnt even when some of them are quite noisy or distorted. Some of the original images are shown below:

The target patterns defined in this exercise is relatively simple, which can be simply defined by the so-called one-per-class coding:

Class 1 → 1 0 0 0 0
Class 2 → 0 1 0 0 0
Class 3 → 0 0 1 0 0
Class 4 → 0 0 0 1 0
Class 5 → 0 0 0 0 1

A two-layer feedforward network MLP is supposed to be powerful enough for this logo recognition task. A 15x15 logo image is represented by 225-element input vectors, so the neural network needs 225 inputs and 5 output neurons. The network receives 225 Boolean values, which represents one logo image. It is then required to identify a logo by producing an output vector, the element of which with highest value indicates the class of input logo. The *logsig* (Log Sigmoid) is chosen as the transfer function for both hidden and output layers. This is because it has a suitable output range ([0 1]) for the current problem.

You are required to randomly split the given logo images into training and testing parts, for example, 80% for training while the remaining 20% for testing. Then set up MLP on the training data with the appropriate parameters

Compute a MLP with 50 hidden units and a logistic out function, and use 800 iterations to fit it. What is the averaged error on the training data? What is the averaged error on the test data? What do you think is the reason for a difference? Make your comment.

Questions:
What do you think is a sensible number of hidden units and iterations? What is an appropriate output function? Comment and then compute the results using the setting you proposed.