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Lappeenranta University of Technology

BM40A0700 Pattern Recognition

Lasse Lensu

Exercise 9: Artificial neural networks (ANNs)

1. Multilayer perceptron (MLP) (1 point): Download the provided Matlab function which implements a two-layer MLP. The network has one hidden layer with hyperbolic tangent as the activation function and a linear output layer. Study the source code and comment it thoroughly.

   Additional files: `mlp.m`

2. MLP training and convergence (1 point): Test the provided MLP implementation using the given three data sets. Use the training data also as test data.

   If a run does not converge onto a reasonable level, you can train with the same data several times. What is the classification result in each test? Use the provided Matlab function to plot the results.

   Additional files: `data1.mat, data2.mat, data3.mat, mlp.m, plotmlp.m`

3. Generalization (1 point): Experiment with the MLP using different numbers of hidden layer neurons (for example, 1, 2, 5, 10, etc.) when classifying the given data (`data4.mat`). Do you think all samples in the data set should be correctly classified? Which is the optimal number of hidden neurons for this problem?

   How many hidden neurons are needed to solve the XOR problem?

   Additional files: `data2.mat, data4.mat, mlp.m`.

PO BOX 20, FI-53851 LAPPEENRANTA, FINLAND
E-mail: lasse.lensu@lut.fi