

CIS 732

Machine Learning and Pattern Recognition

Fall, 2001

Homework Assignment 3 (Problem Set)

Sunday, 08 October 2001
Due: Thursday, 25 October 2001
(before midnight Friday 26 October 2001)

This problem set is designed to apply your theoretical understanding of supervised learning using connectionist – i.e., artificial neural network (ANN) and Bayesian belief network (BBN) – models.

Refer to the course intro handout for guidelines on working with other students.

Note: Remember to *submit your solutions in electronic form using **hwsubmit** and produce them only from your personal notes* (not common work or sources other than the textbook or *properly cited references*).

Problems

1. (30 points) **Maximum A Posteriori / Maximum Likelihood (MAP/ML)**. Problem 6.3, Mitchell.
2. (20 points) **Bayes Optimal Classification**. Explain how a stochastic iterative improvement algorithm such as *simulated annealing* can be used to approximate the Bayes optimal classifier. What theoretical and practical limitations (specifically regarding convergence) do such Markov chain Monte Carlo (MCMC) techniques face?
3. (25 points) **Bayesian Belief Networks (BBNs)**. Problem 6.6, Mitchell. Fill in the CPT for the node *Humidity* instead of *Wind*.
4. (25 points) **Neural Computation (NC)**. Problem 19.3, Russell and Norvig

Extra credit

- a) (5 points) Try the *MATLAB Neural Network* toolkit on *Sleep1* and report the same results for a feedforward ANN (specifically, a multi-layer perceptron) trained with backprop. This package can be found on the KDD Core systems, including a Windows version installed on the Hobbits.
- b) (5 points) TBA (SNNS).
- c) (5 points) TBA (Hugin).