Machine Learning 2003

Assignment 1: Problem definition; simple learning algorithm for tic-tac-toe.

- Due by: Part A: 23h59 on 20/02/2003; part B: 23h59 on 27/02/2003
- Marking: Part A: 20 marks; Part B: 50 marks for implementing a working algorithm; 30 marks for experimental evaluation and report (including description of algorithm, presentation of results, discussion and conclusions).
- Remember that discussion and conclusions are the most important part of an assignment!
- Note: this is **not** a team project. Your implementation and experiments should be your own work.

1 Part A: Problem description and formal definition (due 23h59 on Thurs 20 Feb):

Excercise 1.2 in Mitchell, p.18: "Pick some learning task not mentioned in this chapter. Describe it informally in a paragraph in English. Now describe it by stating as precisely as possible the task, performance measure, and training experience. Finally, propose a target function to be learned and a target representation. Discuss the main tradeoffs you considered in formulating this learning task."

You may use any example that is not a game.

2 Part B: Learning algorithm for tic-tac-toe (due 23h59 on Thurs 27 Feb):

Excercise 1.5 in Mitchell, p.18: "Implement an algorithm similar to that discussed for the checkers problem, but use the simpler game of tic-tac-toe. Represent the learned function $\hat{V}$ as a linear combination of board features of your choice. To train your program, play it repeatedly against a second copy of the program that uses a fixed evaluation function you create by hand. Plot the

percent of games won by your system, versus the number of training games played."

Note that your program should use a learning algorithm as discussed in Mitchell, rather than minimax search. Instead of learning by playing against a fixed opponent, you may also choose to learn by playing against a random opponent. Note: this assignment is an opportunity to practice your object oriented design skills.

Your report should discuss your algorithm critically: the following are examples of questions you might choose to address in your discussion. What are its advantages/disadvantages? Which alternative approaches might be used to improve its performance? Which opponent is it optimised to play against, and how will this affect its performance against human opponents?