

CSCI/ARTI 8950 Machine Learning

Assignment Number 1: Due 2/3/2011 (in class)

1. [10 points]

The goal of the Tic-Tac-Toe game is to place three X's or three O's on the same row, column or diagonal on a 3 by 3 board. If you never played it or need more information about it, please visit <http://boulter.com/ttt/> or search for other sites on the web. Our objective in this problem is to learn a good strategy to play Tic-Tac-Toe.

Formulate the Tic-Tac-Toe learning as a machine learning problem. You should briefly describe:

- What exactly would be learned and how it would be represented
- How the training examples will be obtained
- Which learning algorithm will be used

2. [10 points] Solve problem 2.2 on page 48 of the text book.

3. [10 points] Solve problem 2.4 on page 48 of the text book.

4. [10 points][Mid] Consider the EnjoySport concept learning task defined in Table 2.2 of the textbook.

- (a) Give a minimum length sequence of training examples that produces the following version space (represented by its S and G sets):

S: {< ? Warm Normal Strong Cool ?>}
G: {< ? ? ? ? ? ?>}

- (b) Give a minimum length sequence of **additional** training examples that will transform the version space described above into the following version space:

S: {< ? Warm Normal Strong Cool ?>}
G: {< ? ? Normal Strong ? ?>}

5. [10 points][Mid] Consider the following examples for machine learning:

Example	a1	a2	a3	a4	a5	label
1	1	0	0	0	1	+
2	1	1	1	0	0	+
3	0	0	0	1	1	-
4	1	0	1	0	0	+

Each hypothesis is described by a conjunction of constraints on the attributes **a1** through **a5**. The constraints may be “*” (any value is acceptable), “ ϕ ” (no value is acceptable), or a specific value (i.e. 0 or 1).

- (a) Give the sequence of S and G boundary sets computed by the **Candidate-Elimination** algorithm going through the given examples in the given order.
- (b) Would the final version space obtained above change if the examples were considered in reverse order? Briefly explain why.
- (c) Give a minimum length sequence of **additional** training examples that will make the version space converge to one and only one hypothesis.