CSI 5325 Assignment 1

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assigned January 13, 2009; due January 27, 2009

1 Expectations

For all assignments in this class you should work individually, but feel free to discuss your work with me or your classmates.

The writeups you do for this course should be of high quality; complete but concise. Please structure your writeups well, introducing ideas logically (rather than simply chronologically). All this means that you should go over your writeup multiple times, editing as necessary.

Use graphics in your document where they will help – for example when describing a complex object, and especially when giving experimental results. Use graphs with appropriate amounts of labels and explanations.

1.1 Submitting your work

You should turn in all your work in printed format in class, as well as by email to `hamerly@cs.baylor.edu`. Your email should have attached a zip file which has a single folder that contains all your materials. The zip file name should follow this pattern: '`lastname_nn.zip`', where lastname is your last name, and nn is the assignment number (like '01'). Please DO include all source code with your emails, but DO NOT print out your source code to hand in (just print and turn in the final PDF/postscript version of your writeup).

1.2 Tools for the course

Your work should be composed in LaTeX. Since LaTeXis supposed to make beautiful documents, make sure your documents look beautiful! You can find the source of this document at `http://cs.baylor.edu/~hamerly/courses/5325_09s/assignments/assignment01.tex` for an example of LaTeXif you are not familiar with it. There are several links on the course web page with LaTeXtutorials as well.

You are free to use any programming language you would like for this course, but I will strongly suggest that you look at using MATLAB. If you haven't used it before, it will probably take a bit of adjustment, but there are reasons that most modern machine learning research is done in MATLAB. It supports a lot of operations that would take significant time to implement in other languages, and it's got about the right level of flexibility. It also has excellent graphing capabilities. Perhaps most importantly, it allows you to get new ideas implemented quickly and to easily visualize results along the way. There are links on the course web page to get you started in MATLAB.

2 Textbook exercises

Please do the following exercises from our textbook, chapters 1-2.

2.1 Think of a new learning problem (10 points)

Do Exercise 1.2, which asks you to pick and describe a learning task that we haven't discussed and is not discussed in our reading. Describe its various parts – the overall task, the target function, representation

of the learned function, the learning algorithm, the training data representation, how you would gather the training data, and how you would evaluate success of the learning algorithm. Choose a task in which you're interested.

2.2 Tic-tac-toe solver (30 points)

Exercise 1.5 asks you to build a tic-tac-toe solver. Implement this as directed in the problem. Use whatever language you would like, and write up a description of how you designed your learning problem, solved the problem, how it performed, etc. Explain each part of the learning system. Remember that this is about learning from experience/examples, rather than building a perfect player. Also, remember that your writeup and description of your results is just as important, if not more important, than your implementation. Use graphs to describe things like learning rates, weights over time, etc.

For extra fun – compete with your classmates!

2.3 Understanding the size of a hypothesis space (10 points)

Do Exercise 2.1, which asks you to examine the hypothesis space of the *EnjoySport* learning task. Also discuss the following question: why might a smaller (more restricted) hypothesis space actually be better than a larger (more flexible) hypothesis space in any given learning task?

2.4 Rectangular version space (10 points)

Do Exercise 2.4, which asks you to examine the hypothesis space of rectangles in the plane. Please include the graphics in your writeup. To make it easier, you can use the following values for plotting the examples which are on the original diagram:

```
1 3 -
2 6 -
4 4 +
5 1 -
5 3 +
5 8 -
6 5 +
9 4 -
```