050.334/634 — Computational Models of Cognition

Fall 2005
MT 2:30 – 4:00
134A Krieger
http://www.cog.jhu.edu/courses/comp-models/

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Overview

This course will introduce a range of computational techniques for the modeling of cognitive processes. We will explore the role of modeling in cognitive science, and the explanatory power of a number of symbolic, statistical and neural network models in a variety of empirical domains, including language, categorization and reasoning.

I have at least two kinds of goals in teaching this course. On the conceptual side, I hope that students will come away with the ability to critically evaluate the strengths and weaknesses of explicitly formulated computational models in cognitive science. On the practical side, I hope that students will learn a number of fundamental techniques for implementing and analyzing computational models and relating them to data from human cognition, techniques which may prove useful in future research.

Course Requirements

The written work for the course will consist of a number of homework assignments. In these assignments, you will construct and analyze a variety of computational models, using existing packages for the most part. Note that I will not be assuming sophisticated programming background on your part, though such background will certainly not hurt. These assignments will be worth %80 of your grade.

In addition, I expect that you will attend class regularly, do the assigned reading in a timely fashion, and will participate in class discussion. If you have questions about something that comes up during class, on one of the assignments, or in the reading, I implore you to raise it during class. Not only will you be doing yourself a favor in getting the issue resolved, but you will also be helping your classmates, many of whom will (or at least should) have the same question. In addition, I find that when students are consistently engaged in debate and discussion about the class material, they learn much more and are much more likely to retain what they learn. To encourage you to participate in both of these ways, I will assign %20 of the course grade on the basis of constructive class participation.

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of

assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition.

In this course specifically, you may discuss the homework assignments in this course with your fellow students, and indeed I encourage you to do so, as working with others will often provide you with insights into other ways of thinking about the material. However, it is vitally important that the answers you provide in your written work, whether prose or programs, represent your work alone and not something copied from the work of your classmate.

Report any violations you witness to the instructor. You may consult the associate dean of students and/or the chairman of the Ethics Board beforehand. See the guide on "Academic Ethics for Undergraduates" and the Ethics Board web site (http://ethics.jhu.edu) for more information.

Reading

There will be no single textbook for the course. Instead, we will make use of readings from a variety of sources, including pieces of textbooks and journal articles. I will make these available in hard copy and electronically as the term progresses.

(Tentative) Course Outline and (Partial) Reading List

Because this is the first time that I am offering the course, the range of topics and rate of progress is subject to substantial revision during the course of the term. That said, the following is a rough outline of the topics I intend to cover. I will hand out revised and elaborated versions of this outline as the term progresses.

Topic	Subtopic	Readings
Computation and Modeling in Cognitive Science		Marr, David (1982) *Vision*. San Francisco: W.H. Freeman. (excerpt) Haugeland, John (1981) Semantic Engines: An Introduction to Mind Design. In J. Haugeland (ed.) *Mind Design*. Cambridge, MA: MIT Press. Newell, Alan (1973) You can't play 20 questions with nature and win: Projective comments on the papers of this symposium. In W. G. Chase (ed.), *Visual Information Processing*. New York: Academic Press.
Symbolic Modeling	Introduction to PROLOG	
	Knowledge Representation and Inference	
	Grammars and Parsers	
	Production Systems	
Neural Networks	Network Basics	
	Reading	
	Simple Recurrent Networks and the Emergence of Grammar	
Statistical Modeling	Basic Concepts	
	Statistical Learning and Word Segmentation	
	Bayesian inference and category induction	
	Information theory and grammar	