

CS 931: Combinatorial Search and Heuristic Optimization, Spring 2011

<http://www.cs.unh.edu/~ruml/cs931/>

Mondays and Wednesdays, 10:40am-noon, Kingsbury N233

Overview

The overall goal of this class is to help you learn about **current research in artificial intelligence** by doing it. We'll read papers and do research projects on topics on combinatorial search and heuristic optimization. As a consequence, you will also learn **how to cope with intractable combinatorial optimization problems**. By the end of the class, you will be able to read a research paper critically, carry out a small research project successfully, and write it up clearly. You'll also know how to solve some optimization problems.

We'll focus on techniques from artificial intelligence that attempt to combat intractability by exploiting as much available information as possible. We'll cover concepts and algorithms for solving shortest-path, constraint satisfaction, and combinatorial optimization problems, and their application in areas such as planning, robotics, and bioinformatics. The emphasis will be on important or recent papers in the field.

You should already be a fluent programmer and have familiarity with common data structures and basic complexity analysis. If you haven't had an introduction to artificial intelligence, you should check with me before taking the class. Optimization problems crop up everywhere and you are encouraged to select topics that relate to other classes or interests that you have.

Contact Info

Prof. Wheeler Ruml

ruml at cs.unh.edu, Kingsbury W233, 2-2683

Office hours by appointment

I will meet individually with you each week to talk about how your research is going.

Evaluation

Tentative breakdown:

- 15% written reviews of the papers we read for each class
- 5% presenting and leading discussion on a subset of the papers
- 5% your project proposal, which will consist of a short written proposal and, after it has been approved, a brief oral presentation
- 5% your final oral presentation of your project
- 70% a final paper, written in the style of an AI conference paper, which will describe original research you have carried out on a topic related to the course

There will not be a final exam for this course.

Secondary Texts

There is no required text for this class—we will be reading the primary literature. Papers will be linked from the course website when possible. However, you might find some of these books interesting or useful:

- Judea Pearl, *Heuristics: Intelligent Search Strategies for Computer Problem Solving*, Addison Wesley, 1984. The classic monograph on heuristic search. The proofs are still valid but there have been many subsequent developments.
- Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, third edition, Prentice Hall, 2010. A good introductory AI text that you should buy if you don't have it already. The second edition is good enough unless you plan to continue in AI after the course.
- Paul Cohen, *Empirical Methods for Artificial Intelligence*, MIT Press, 1995. Techniques for experimental design and data analysis.
- Edmund Burke and Graham Kendall, *Search Methodologies: Introductory Tutorials in Optimization and Decision Support Techniques*, Springer, 2005. Covers several techniques that we won't.
- Holger Hoos and Thomas Stützle, *Stochastic Local Search: Foundations and Applications*, Morgan Kaufmann, 2005.
- Edward Tsang, *Foundations of Constraint Satisfaction*, Academic Press, 1993.
- Rina Dechter, *Constraint Processing*, Morgan Kaufmann, 2003. Relatively theoretical in its outlook.

Legalese

All your work in this class should be your own — any collaboration must be cleared with me in advance and you must cite all sources you use in preparing your work. As a scientist, I take a dim view of academic dishonesty and UNH policy provides for actions starting with failing the course and including dismissal from the University.

If you are registered with the student disability office, please let me know privately as soon as possible so that I can provide proper accommodation.