CS664 Knowledge-Based Systems
Summer 2003

Instructor: Dr. Richard Greene

Syllabus

TextBook: Introduction to Expert Systems, 3rd edition, Peter Jackson, Addison-Wesley Press, ISBN: 0-201-87686-8. Supplemental readings may be handed out.

Course Administration:

1. Please read the text before coming to class. The lectures are intended to supplement and extend the text material. I do not intend on simply reading back the chapter to you. (I hope you would be very bored as well if I do this)
2. Please do all homework – often the goal of the homework is not to get the 'right answers' but to force you to have certain experiences and face certain situations. I often use homework as a test of how well I am doing – do you understand certain topics, can you do what I think you can, etc.
3. Because you are adults and have lives and families and jobs, do not worry that I am taking attendance, or will 'take off points' if you miss class, come in late, etc.
4. To me, if you are interested and are having some fun – then you become motivated to learn and excel. I try to make my courses fun and interesting for this reason.
5. Because 'real' expert systems projects require a lot of domain knowledge and technical knowledge, we are forced to use examples that do not seem like 'expert problems' or may even seem trivial to approach using this technology. When you start to think this way, try to re-focus on the fact that in real life, we'd be trying to implement a system in an area we are totally clueless in – almost about everything from terminology to problem solving techniques. Years ago, I worked with NASA on a realtime expert system for controlling the chemical process that makes the ablative covering for the space shuttle. To be honest, I did even know what an 'ablative' was and when I found out, it did not help much. Be happy you are avoiding the initial frustration fo dealing with a domain expert AND the field of AI.
6. I will definitely be out of town at least once during the term, hopefully with plenty of warning. We'll worry about that when it happens.

Course Topics:

This course is an introduction to the field of knowledge-based and expert systems. We will start with a general description of what expert and knowledge-based systems are. Through the semester, we will examine knowledge-based systems approaches including rule-based systems and chaining approaches, frames and networks, logic programming, uncertainty-based approaches, and task-level approaches. During this examination, we will consider many historically significant systems such as Mycin, Dendral, R1, Internist, Hearsay, CENTAUR, COMPASS, OPAL, MOLGEN, MUD, and CHEF. Other topics will include knowledge acquisition and knowledge acquisition tools such as MORE, TEST and SALT, automated explanation, knowledge-based system tools such as EMYCIN, CLIPS, OPS5 and the Generic Task Toolset, and blackboard architectures. We will examine classes of problems such as diagnosis and planning. There will be some attention given to Artificial Intelligence topics of search, knowledge representations, learning and case-based reasoning.

In order to apply the knowledge, all students will be expected to participate in the research, design, and implementation of a knowledge-based system. This will constitute a majority of the student's activities during the semester and be a large fraction of the student's final grade. The student will also solve smaller problems through programming projects in order to learn some of the concepts.

Course Assignments

1 Major Project:	25%
Graded Homework:	25%
Midterm:	25%
Final:	25%

Description of Major Project:

All students will be required to participate in the implementation of a knowledge-based system. Students must work alone. The system may be written "from scratch" using a high-level programming language, or maybe be constructed using one of several tools such as OPS5, CLIPS or the Integrated Generic Task Toolset.

Aside from implementing the system, students will be required to research a domain for their system, submit an initial proposal, submit occasional progress reports, provide a written report at the end of the semester and possibly give a presentation or demonstration of the system at the end of the semester. Each one of these will be graded separately and together will constitute 25% of the student's grade.

The knowledge-based system must solve a real-world problem. It should have some of the following features (but not all): reasonable representation of knowledge, sufficient quantity of real-world knowledge to solve an interesting problem, reasonable accuracy in solving the problem, knowledge-acquisition abilities, learning abilities, explanation generation abilities, dealing with uncertainty, ability for expansion, natural language understanding abilities, case storage and retrieval.

Tentative Lecture schedule: we shall try to cover the following topics but I am not worried about rushing through this ambitious schedule. I would rather have you firmly understand each topic that to be able to able trivia questions about all these topics.

Week	Chapter	Topic	System Covered
1	1, 2	Intro to Expert Systems and AI	
2	3	Knowledge Representation	Intro to Clips
3	3, 5	Knowledge Representation, Rules	Strips, MYCIN
4	5, 6	Rules cont., Networks/Frames	CLIPS
5	8, 9	Logic, Uncertainty Handling	Prolog, Planner, MYCIN
6	10	Knowledge Acquisition, Tools	KADS, Emycin
7	11, 12	Heuristic Classification	Mycin, Mud, MDX
8	13, Supplemental	Hypothesize and Test, Generic Tasks	Centaur, Internist, Red
9	14, 15	Constructive Problem Solving	R1, Molgen, VT, SALT
10	17, Supplemental	Tools, Generic Tasks	Emcyin, OPS5, GT Tools
11	16	Explanation, NLU/NLG	Mycin, Centaur, Xplain
12	18, 21	Blackboard Architectures, Belief Nets	Hearsay, Protean, Pearl
13	20, 22	Machine Learning, Case-based Reasoning	MetaDendral, ID3, Chef
14	Supplemental	Miscellaneous Topics	
15	none	Student Presentations	