ECE 566

Knowledge Systems Engineering

Syllabus

Credits: 3 units
Instructor: Dr. Michael Marefat
Office/Email: ECE356G, marefat@ece.arizona.edu
Office Hours: Tuesdays and Thursdays 3:00 -4:00 pm, and other times by appointment. Please send email to marefat@ece.arizona.edu

Objectives: Review and in depth investigation of fundamental techniques in engineering of knowledge systems.

Contents

MODULE I

1. Search Methods
   Depth-first Search
   Breadth-first Search
   Heuristic Search
   Hill Climbing

2. Constraints, Constraint Networks, Constraint Satisfaction
   Node and arc Consistency, Compound Labeling
   Constraint Satisfaction
   Problem Reduction
   Look ahead
   Back Jumping
   Interval Constraints, Interval calculus
   Algorithms for Interval Constraint Satisfaction

3. Knowledge Representation and inference in first order logic

   First Order Logic
   Matching and Unification,
Rule Firing, forward and backward chaining
Search

MODULE II
1. Automated Planning and Problem Solving
   Total Order problem solvers
   Least Commitment Planning
   Hierarchical Problem solving
   Application in Process Planning and Manufacturing

2. Structured Knowledge Representation
   Frames, Objects, Semantic Networks
   First Order Logic Correspondence
   Matching
   Mechanical Inference
   Defaults, Inheritance

3. Distributed Knowledge Systems
   Blackboard Architecture,
   Control Mechanism and Coordination
   Distributed Agent Systems
   Knowledge Sharing

MODULE III
1. Certainty Factors
   Certainty Factor Combination
   Implementation in Mycin System

2. Bayesian Probabilistic Networks
   Fundamentals from Probability Theory
   Likelihood Vectors
   Conditional Probability Matrices
   Hierarchical Propagation of Evidence
   Computational Algorithms for General Networks

3. Dempster-Shafer Theory of Evidence
   Belief Interval Representations for uncertainty
   Evidence Accumulation and Propagation
   Algorithms for fast Computation
Requirements and Grading

The requirements in this course include
• 3-4 projects which include programming.
• Two class examinations
• One semester project with a report.
• Each student is expected to do a survey project and prepare a semester report. A topic in knowledge systems (instructor approved) will be provided for survey.

The following will be the basis for grading:

<table>
<thead>
<tr>
<th>Assignments (3)</th>
<th>30 %</th>
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<tbody>
<tr>
<td>Final Project (1)</td>
<td>30 %</td>
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<tr>
<td>Exams (2)</td>
<td>40 %</td>
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<td><strong>TOTAL</strong></td>
<td><strong>100 %</strong></td>
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