

## CS 6200 : ADVANCED TOPICS IN ARTIFICIAL INTELLIGENCE

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|------------------------|----------------------|-------------------------|
| <i>Semester Hours:</i> | 3.0                  | <i>Contact Hours:</i> 3 |
| <i>Coordinator:</i>    | Jong Kwan "Jake" Lee |                         |
| <i>Text:</i>           | TBD                  |                         |
| <i>Author(s):</i>      | TBD                  |                         |
| <i>Year:</i>           | TBD                  |                         |

### SPECIFIC COURSE INFORMATION

#### *Catalog Description:*

Intensive study of a major sub-field such as neural networks, expert systems, machine learning/tutoring, natural language processing, pattern recognition, robotics, or others.

Course Type:               **ELECTIVE**

### SPECIFIC COURSE GOALS

- TBD

### LIST OF TOPICS COVERED

- Introduction
  - Definitions
    - AI, Expert System, Rule-Based Expert System (RBES)
  - How an RBES works
  - Brief history of RBES
  - Applications of RBES
- Foundation of REBES: Rule-Based Production Systems (RBPS)
  - Production system formalisms
  - Operational principles of RBPS
  - Evaluation of RBPS
    - Advantages
    - Disadvantages
- Inference Engines (Automated RBPS)
  - Search
  - Chaining
  - Conflict resolution
  - Success and failure

- Development of RBES using CLIPS (NASA's RBES tool)
  - Tutorial on CLIPS
  - Preconditions
  - Stages
    - Problem selection
    - Knowledge acquisition: elicitation and induction
    - Knowledge representation: facts and rules
    - Design of the human interface
    - Design of the production system
    - Design of the explanation system
    - Iterative prototyping
    - Verification: consistency and completeness
    - Validation
    - Application
  - Problems and pitfalls
- Fuzzy Logic
  - Representation of uncertainty
    - Abstraction as a solution
    - Bayesian logic as a solution
    - Certainty factors as a solution
    - Fuzzy logic as a solution
  - Tutorials on fuzzy logic
    - Classical Set Theory (Cantor)
      - Relationships: complement, containment, intersection, union
      - Formal definitions
      - Membership graphs: S, Z, and Pi
      - Linguistic Variables, Values, and Modifiers (Hedges)
    - Multi-Valued Logic (Lukasiewics)
- Development of RBES Using Fuzzy CLIPS
  - Tutorial on Fuzzy CLIPS (an extension of CLIPS)
  - Design considerations
    - Preconditions for a "Fuzzy" solution
    - Methods of representing uncertainty in Fuzzy CLIPS
  - Major application areas for fuzzy expert systems
  - Advantages of Fuzzy Inference Control
- Case Studies of Successfully Deployed Expert Systems
  - MACSYMA
  - MYCIN
  - XCON
  - PROSPECTOR
- Evaluation of Expert Systems
  - Ethical issues in expert systems

- Benefits of expert systems compared to human experts
- Limitations of expert systems