Symbolic Processing

Instructor: Paul Tarau, Associate Professor - see my home page for contact information.

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Description and Objectives:

Introduction to symbolic processing using Prolog. Declarative programming, recursion, data abstraction, definite clause grammars. Introduction to AI, search algorithms, two person games. Modeling Neural Networks, Genetic Algorithms. AI applications using object oriented and functional languages.

Syllabus

• Introduction to Symbolic Processing with Prolog
  • Terms and lists, unification
  • Predicates, definite clauses, declarative programming
  • Introduction to recursion - symbolic arithmetic with successor function
  • Simple list processing with recursive Prolog programs
  • Defining and querying simple relations in Prolog
  • Definite Clause Grammars
  • Higher-order programming, dynamic database updates
  • Sequences, sets, multiset, permutations
  • Symbolic computation with polynomials
• Symbolic Processing in Artificial Intelligence
  • Depth-first search and backtracking in Prolog
- Breadth first search and iterative deepening
- A*-search and heuristic search algorithms
- Search algorithms for 2-person games
- AI techniques for problem solving, games, puzzles
- Case study: SUDOKU in Prolog
- Accelerating algorithms with constraint solving

- Symbolic processing in functional and object oriented languages
  - Running Scala programs using the Java JDK and Eclipse
  - Case classes and pattern matching in Scala
  - Implementing AI algorithms in a functional programming style
  - Implementing AI algorithms in an object-oriented programming style

- Applications of Artificial Intelligence
  - Neural networks
  - Genetic algorithms
  - Natural language processing and knowledge representation

- **Pre-requisite:** CSCE 2110 Computing Foundations II.

- **Resources:**
  - Prolog Tutorial, Scala Tutorials.

- **Software:**
  - Prolog from this website, Scala from this website
  - The Eclipse Open Software Development Platform
• **Wolfram Alpha**

**Evaluation**

• Individual Exams: 50%

• Assignments (groups of 2-3): 50%