Teil XI

Prolog Prolog
Prolog created around 1972 by Alain Colmerauer
stands for programmation en logique
famous compiler by David Warren based on Warren Abstract Machine
lecture loosely based on Ivan Bratko, Prolog Programming for Artificial Intelligence
prolog interpreter/compiler used in the lecture available from www.swi-prolog.org
today’s material: JK Rowling, Harry Potter and the Philosopher’s Stone
Logic Programming

- program defines relations over terms
- query: ask for information about relations
- relations often called predicates
- relations defined in terms of clauses being
  - facts or
  - rules
- sets of facts and rules represent assumptions or knowledge
- queries are answered by logical deduction
Facts

- define relations `wizard` and `witch`
- `wizard(harry)`.
- `wizard(dumbledore)`.
- `witch(hermione)`.
- `witch(ginny)`.
- `good(harry)`.
- `friends(ron, hermione)`.
- syntax: predicate names must start with small letters
Terms

- the only data structure and the only type
- terms are one of
  - logical variable (start with capital letter): X, Tail
  - atoms (start with small letters): harry, cho
  - special variable wildcard (underscore)
  - composed term of a functor (an atom) and argument terms
- built-in terms
  - integers: 1, 2, 3, ...
  - lists: [], [1,2,3], [ H | T ]
both predicates and atoms have an arity
which is their number of arguments
different arities define different predicates/atoms
sample terms and predicates
  • node(X,leaf)
  • nettle_wine
  • wizard(X)
example: \textit{whitemagic}(X) :- wizard(X), good(X).

read (1): $X$ is in the relation \textit{whitemagic} \textbf{IF} it is in the relation \textit{wizard AND} in the relation \textit{good}

read (2): in order to \textit{show} that $X$ is a white magician, \textit{show} that it is a wizard, then \textit{show} it is good

(1) \textbf{logical} interpretation, (2) \textbf{procedural} interpretation

general form: $p(t_1, \ldots, t_k) : - q_1(t_{11}, \ldots, t_{1k_1}), \ldots, q_m(t_{m1}, \ldots, t_{mk_m})$.

$p(t_1, \ldots, t_k)$ is \textbf{head} of the rule

$q_1(t_{11}, \ldots, t_{1k_1}), \ldots, q_m(t_{m1}, \ldots, t_{mk_m})$ is \textbf{body} of the rule
Rules (2)

- body of a rule: conjunction of goals
- relation defined by a sequence of clauses
- sequence of clauses: different alternatives
- example: `whitemagic(X) :- witch(X), good(X).`
- a fact is a rule, where the body is true
- more examples:
  - `friend(X,Y) :- bad(X), bad(Y).`
  - `friend(X,Z) :- friend(Z,X).`
Queries

- query is a **conjunction of goals**
- all goals must be met
- general form: $\text{?- } q_1(t_{11}, \ldots, t_{1k_1}), \ldots, q_m(t_{m1}, \ldots, t_{mk_m})$.
- Prolog tries to prove the query based on the program by **resolution** and **unification**
- if query contains **variables**, Prolog finds (all) **satisfying substitutions**
- interpreter: ?-
Conclusion

- Prolog syntax: facts, rules, queries, terms
- Potion puzzle solution in Prolog
- next week: how Prolog finds solutions