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Rule-based expert systems overview and concepts

Expert systems

• One of most applied and successful "intelligent" sort of technology
• Basic idea:
  • take one or more experts in a specific field
  • drain their brains for knowledge
  • formalize it into rules that are put into system that can reason using them
  • "expert" themselves may use system — or fire the experts and hire lower educated people...
• 15-20 y’s ago "knowledge engineering" was thought to become a new major trend
  • books-books-books
  • courses-courses-courses
  • proposals for educational programs in K.E.

History and applications (sketch)

• MYCIN, Mid 1970'ies (Stanford Univ. USA)
• successful rule-based system for medical diagnosis
• EMYCIN, around 1980, "shell" for developing expert systems
• Quite many commercial systems and developer shells
• Recent overview paper:
  • Expert System in Real World Applications
    http://www.generation5.org/content/2005/Expert_System.asp
• Agriculture, education, environmental management, medicine
• Also: Repairing complicated machinery (cars, trains, planes ...)

Basic principles

• If-then rules
  • forward and backward chaining
  • often with probabilities, fuzzy, other (ad-hoc) uncertainty measures
  • often with dialogue with the user

Example:

• Prolog seen as rule-based expert system shell with backward chaining and no uncertainty and very little dialogue
A rule, forward and backward chaining

IF rains AND go-out AND NOT umbrella THEN get-wet

**Forward:**
From known facts rains, go-out, NOT umbrella
conclude get-wet

**Backward:**
For testing hypothesis get-wet, you need to check whether rains, go-out and NOT umbrella holds

Demonstrations

- Prolog as backward chaining
- Version that requires user to edit the program
  ?- ['my_kb0Prolog.txt'].
- Prolog extended with ask-user facilities
  ?- ['expert0.txt'].
  ?- ['my_kb0.txt'].
  (order is important)