Intelligent Tutoring Systems

Intelligent User Interfaces

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Readings

- Conati et al, *On-Line Student Modeling for Coached Problem Solving Using Bayesian Networks*, UM'97

- Rickel & Johnson, *Integrating Pedagogical Capabilities in a Virtual Environment Agent*, AA'97

Basic Concepts

- Goals/tasks (to be learned)
  - usually about learning skills, not facts
    - e.g., how to solve physics problems
    - not the capitols of the 50 states
- Student model
  - generic component
  - specific to student
- Pedagogical strategies
  - what order to present problems
  - when to intervene

Basic Processes

- Tutorial presentation
  - text, graphics, dialogue, VR, etc.
  - may be manually authored or dynamically generated (or mixture)
- Assessment
  - formative: during learning (can adjust system behavior)
  - summative: final result
  - diagnosis, plan recognition
  - knowledge tracing

Basic Processes (cont'd)

- Data mining
  - analyzing logs using machine learning techniques
  - to improve cognitive models
  - to improve pedagogical strategies

Strong vs. Weak Cognitive Modeling

- All modern systems have some (cognitively oriented) *representation* of what is to be learned, which is separate from the tutorial *presentations*
  - vs. early CAI systems "interactive page turners"
  - *Strong version:*
    - system capable of solving domain problems itself
    - tutorial presentations created automatically
  - *Weak version:*
    - abstract cognitive representation (e.g., skill names)
    - but tutorial presentations are *authored*

Other Important Issues

- Reuse across domains
  - generic "middleware" vs. domain-specific systems
  - requires better knowledge representation
- Authoring tools (for human developers)
  - crucial for scaling up to real deployment
  - authoring of cognitive models
    - most demanding for strong models
  - authoring of presentations
    - for weak model systems

Other Important Issues (cont'd)

- Dealing with uncertainty
  - many sources of uncertainty
    - ambiguity in plan recognition
    - unknown student knowledge state
    - speech recognition error ?

Readings

- Conati et al, *On-Line Student Modeling for Coached Problem Solving Using Bayesian Networks*, UM'97
  - Bayesian network is "weak" representation, but which deals very well with uncertainty
  - But network derived *offline* from strong representation (rule-based solver)
- Rickel & Johnson, *Integrating Pedagogical Capabilities in a Virtual Environment Agent*, AA'97
  - "strong" modeling approach
  - does not deal with uncertainty