Introduction to Cognitive Robotics

Conclusions
1. Further Issues
2. Applications
3. References
4. Pointers

Theory of Actions: Further Issues

- Exogenous Actions
- Probabilistic action occurrences and effects
- Ability
- Time
- Concurrency
- Hypothetical and Counterfactual Reasoning
- Agent beliefs, desires, intentions
- Real time, resource bounded behavior
- Belief revision
- Execution monitoring and failure recovery

Concurrency in Situation Calculus

walk and chew gum

- \textsc{Walking}(x, y, s) (fluent)
- \textsc{StartWalk}(x, y) (action)
- \textsc{EndWalk}(x, y) (action)

\[ \{ \textsc{StartWalk}(A, B), \textsc{StartChewGum} \}
\{ \textsc{EndChewGum}, \textsc{StartSing} \}
\{ \textsc{EndWalk}(A, B) \} \]

Concurrency (cont)

\[ \text{Walking}(x, y, do(a, s)) \leftrightarrow \]
\[(\exists r) \{ a = \text{StartWalk}(x, y); \forall \text{Walking}(x, y, s) \land a \neq \text{Walk}(x, y) \} \].

\text{Poss}(\text{StartWalk}(x, y), s) \leftrightarrow
\[ \neg (\exists u, v) \text{Walking}(u, v, s) \land \text{Location}(x) = x \]
\text{Poss}(\text{EndWalk}(x, y), s) \leftrightarrow
\text{Walking}(x, y, s) \]
Applications

- Robots
  - Logolog: Inexpensive Experiments in Cognitive Robotics (Levesque and Pagnucco)
    http://www.cs.toronto.edu/~morri/Legolog
  - Museum Tour Guide [Bonn – CMU]
    http://www.i5.informatik.rwth-aachen.de/kt
- Hypertext — Scherl, Bieber, and Vitali
- Animated Characters — John Funge *A.I. for Games and Animation*, A.K. Peters, 1999
- Software Agents — Ruman and Levesque, Banking Agent
- Using the internet
  - Sheila A. McIlraith, Tran Cao Son and honglei Zeng, “Semantic Web Service,” *IEEE Intelligent Systems*, March/April 2001

Cognitive Robotics


Pointers

- http://www.cs.toronto.edu/cogrobo
  University of Toronto Cognitive Robotics Group
- http://casbah.ee.ic.ac.uk/~mpsha
  Murray Shanahan’s web page
- http://www-i5.informatik.rwth-aachen.de/kbsg
  Aachen Knowledge Based Systems Group

Pointers (cont)

- http://www.ida.liu.se/
- http://www.public.asu.edu/~cbaral/
  Chitta Baral
  Principles of Knowledge Representation and Reasoning, Incorporated
  http://www-formal.stanford.edu/~leora/cs/
  Common Sense Problems
- http://www.ida.liu.se/ext/etai/lmw
  Logic Modeling Workshop