Cognitive Robotics
Reasoning about Action for Robots and Agents

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In this talk, I will give an overview of an approach developed with Hector Levesque, Ray Reiter, and others, to provide effective reasoning capabilities to robots and software agents that operate in real environments. The framework is based on the Situation calculus, a language of predicate logic for representing dynamic domains. In real applications, plan synthesis is often too inefficient. Instead, we take our agents to be executing high-level programs that have been largely pre-scripted. We have extended the Situation Calculus with a language for expressing such high-level programs, i.e., complex actions. This yields a programming language whose primitive instructions are domain-dependent actions that the robot can perform and whose tests contain predicates that are affected by these actions. These are specified in a Situation Calculus domain theory. Programs can contain nondeterministic choice points where lookahead is necessary to make a choice that leads to succesful termination. As in planning, reasoning about the preconditions and effects of actions is required to find a sequence of actions that constitutes a legal execution of the high-level program. The programmer can control the search effort required by using nondeterminism judiciously. Our framework includes a solution to the frame problem and supports the modeling of knowledge and knowledge-producing actions. A logic programming implementation of the language has been developed. We will illustrate the use of the framework using robotics applications.

References

[1] Y. Lesperance, H.J. Levesque, and R. Reiter. A Situation Calculus Ap-

proach to Modeling and Programming Agents. To appear in A. Rao and M. Wooldridge, editors, Foundations and Theories of Rational Agency, Kluwer, 1998. Available from `http://www.cs.toronto.edu/~cogrobo`.

[2] Y. Lesperance, K. Tam, and M. Jenkin. Reactivity in a Logic-Based Robot Programming language. To appear in Working Notes of the AAAI Fall Symposium on Cognitive Robotics, Orlando, October, 1998. Available from `http://www.cs.toronto.edu/~cogrobo`.