A Basic Level of Attentional Behavior for Manipulation, Interaction, and Learning

Stephen Hart, Shichao Ou, John Sweeney, and Rod Grupen
Computer Science Department
University of Massachusetts Amherst
{shart, chao, sweeney, grupen}@cs.umass.edu

June 30, 2006

This poster provides an overview of our learning and manipulation framework for humanoid robots. This framework provides ways for:

1. quick and efficient learning of complex manipulative and interactive behavior through autonomous exploration,
2. programing the robot via demonstration,
3. adapting learned policies to run-time environmental context,
4. grounding communicative actions,
5. uncovering hidden-state in the robot's observable feature space, and
6. transferring domain-general *implicit* knowledge, such as "handedness" across tasks.

The framework initially gives the robot a small number of native control primitives, or reflexes, that the robot can assemble stochastically in a hierarchical fashion. The robot is driven to learn new behavior by an inherent desire to generate new stimuli on its multi-modal receptors.

We performed experiments on Dexter, the UMass humanoid pictured in Figure 1, to generate robust and fault-tolerant manipulation behaviors, such as grasping, sorting, pointing and nodding. Teleological programming by demonstration uses the robot's own controllers as filters for interpreting the demonstrator, filters that focus on the goals of actions. Moreover, the robot can use its controllers to predict actions of the demonstrator; this can lead to faster, more efficient demonstrations. We will present results from teleoperation experiments on Dexter that show this approach to programming by demonstration.

Figure 1: Dexter, the UMass bimanual humanoid.