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Author

Mataric, Maja J

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Learning in Complex Environments: Biological and Artificial Adaptive Behavior

Maja J Mataric
Volen Center for Complex Systems
Computer Science Department
Brandeis University
Waltham, MA 02254
maja@cs.brandeis.edu

In the last decade, the problems being treated in Artificial Intelligence and Robotics have witnessed an increase in complexity as the domains under investigation have transitioned from theoretically clean scenarios to more complex dynamic environments. Agents that must adapt in environments such as the physical world, a factory floor, an active ecology or economy, and the World Wide Web, challenge traditional assumptions and approaches to learning. As a consequence, novel methods for automated adaptation, action selection, and new behavior acquisition have become the focus of much research in the field.

This workshop will focus on situated agent learning in challenging environments that feature noise, uncertainty, and complex dynamics. In all cases we will consider, learning and adaptation occurs during the lifetime of a complete agent situated in a dynamic environment, and must deal with many the following challenges:

- learning from ambiguous perceptual inputs

- learning with noisy/uncertain action/motor outputs

- learning from sparse, irregular, inconsistent, and noisy reinforcement/feedback

- learning in real time

- combining built-in and learned knowledge

- learning in complex environments requiring generalization in state representation

- learning from incremental and delayed feedback

- learning in smoothly or discontinuously changing environments

The goal of this workshop is to bring together four researchers dealing with just those problems. The four speakers of the workshop are Simon Giszter, Maja Mataric, Andrew Moore, and Sebastian Thrun. Each has experience with different aspects of adaptive behavior and learning, and will each present their work and insights. All will share a common thread of dealing with complex adaptive agents and domains, but each will introduce a different methodology to dealing with the many challenges of learning and adaptive behavior in complex environments.

- **Simon Giszter** will give a biological perspective, overviewing the complex mechanisms involved in biological motor control and learning.

- **Maja Mataric** will overview the issues involved in learning in a complex, multi-robot domain, and present the results of applying a behavior-based approach to control and learning in that domain.

- **Andrew Moore** will describe the issues involved in applying integrated reinforcement learning to a complex factory domain.

- **Sebastian Thrun** will present a framework for life-long learning, an approach to reusing knowledge from what the agent has previously learned.