

# Autonomous Learning Agents: Layered Learning and Ad Hoc Teamwork

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## ABSTRACT

In order to achieve long-term autonomy in the real world, fully autonomous agents need to be able to learn, both to improve their behaviors in a complex, dynamically changing world, and to enable interaction with previously unfamiliar agents. This talk begins by presenting layered learning, a hierarchical machine learning paradigm that enables learning of complex behaviors by incrementally learning a series of sub-behaviors. Layered learning was the key deciding factor in UT Austin Villa's recent RoboCup 3D simulation league championship. The talk then introduces ad hoc teamwork as an emerging multiagent learning challenge. Ad hoc teamwork is based on the premise that as autonomous agents become capable of long-term autonomy, they will increasingly need to band together for cooperative activities with previously unfamiliar teammates. In such "ad hoc" team settings, team strategies cannot be developed a priori. Rather, an agent must learn to cooperate with new teammates on the fly. This talk reports on both theoretical and empirical ad hoc teamwork results, including from recent "pick up" RoboCup robot soccer competitions.

## CCS Concepts

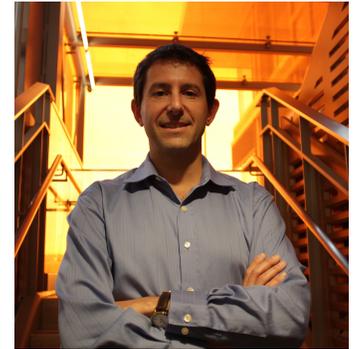
•Computing methodologies → Multi-agent systems; Multi-agent reinforcement learning; •Computer systems organization → Robotic control;

## Keywords

Autonomous agents; multiagent systems; layered learning; ad hoc teamwork; reinforcement learning; RoboCup soccer

## Short Bio

Peter Stone is the David Bruton, Jr. Centennial Professor of Computer Science at the University of Texas at Austin. In 2013 he was awarded the University of Texas System Regents' Outstanding Teaching Award and in 2014 he was inducted into the UT Austin Academy of Distinguished Teachers, earning



him the title of University Distinguished Teaching Professor. Professor Stone's research interests in Artificial Intelligence include machine learning (especially reinforcement learning), multiagent systems, robotics, and e-commerce. Professor Stone received his Ph.D in Computer Science in 1998 from Carnegie Mellon University. From 1999 to 2002 he was a Senior Technical Staff Member in the Artificial Intelligence Principles Research Department at AT&T Labs - Research. He is an Alfred P. Sloan Research Fellow, Guggenheim Fellow, AAAI Fellow, Fulbright Scholar, and 2004 ONR Young Investigator. In 2003, he won an NSF CAREER award for his proposed long term research on learning agents in dynamic, collaborative, and adversarial multiagent environments, and in 2007 he received the prestigious IJCAI Computers and Thought Award, given biannually to the top AI researcher under the age of 35.

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