

# Robots Learning Interactively from Human Teachers

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## Abstract

The Robots Learning Interactively from Human Teachers AAAI symposium was held in Arlington, VA between November 2-4, 2012. The main goal of the symposium was to bring together researchers working on interactive robot learning, with a focus on interactions where the human intentionally changes a robot's knowledge or behavior. In addition to the paper presentations, a series of discussion sessions were also organized to highlight the problems and challenges in the interactive learning field as well as initiating a collaborative attempt to define a set of standard tasks for the determined challenges to make the evaluation of new approaches against each other in a controlled manner.

To harness the full capabilities of robots, we should enable human end-users to customize their robots' behaviors and teach them new ones. Furthermore, it should be intuitive for these users to do so — as simple as teaching other humans. Because of its accessibility to non-expert users, interactive learning is a promising method to achieve this goal and has attracted widespread attention in recent years. However, many challenges remain to make these methods applicable to robots.

The goals of this symposium were (1) to increase awareness and interest in interactive learning methods, (2) to foster interdisciplinary collaboration among a diverse set of attendees, and (3) to develop a taxonomy of the various research topics in this area, so as to tie different topics together and discover fruitful directions for future efforts.

The symposium hosted four plenary talks, each focusing on different aspects of interactive learning for robots. John Laird from the University of Michigan gave an overview of the *instructional learning*. This involves humans teaching tasks to a robot with natural language instructions, and by answering the robot's questions.

Julie Shah from MIT talked about human-robot *cross-training* in collaborative manufacturing domains. Her work addresses the challenge of teaching collaborative tasks to robots, by exchanging the roles of the human and the robot back and forth.

Siddhartha Srinivasa from Carnegie Mellon University talked about state-of-the-art methods for manipulation in

cluttered environments, which can be used as a *vocabulary of skills* for learning higher-level tasks.

Finally, Paul Ruvolo from Bryn Mawr College spoke about learning models of *infant-mother interaction*, with applications to generation of infant-like behavior on a robot and detection of abnormal development in infants.

Fourteen peer-reviewed papers were presented throughout the RLIHT symposium. Some common themes in the presented papers were the use of tele-operation for teaching skills to a robot, tele-operation in the context of robotic prosthetics, interactive instructional learning through natural language, active learning through questions asked by the robot, and interactive sequential learning methods such as learning from demonstration or from human-generated reward. Symposium organizers also presented their works in the sessions that aligned with their own research topics.

A highlight of the symposium was a series of organized discussion sessions. During these sessions, attendees sought to identify key challenges of interactive learning and define a set of standardized benchmarking tasks that could be used to compare approaches. In addition, we tried to identify the characteristics of problems for which interactive learning from humans is the ideal approach, and reach an agreement that different approaches (pre-programming, exploration-based learning, planning) might be better solutions for certain problems. With enthusiasm and collaboration from the participants, the symposium concluded with consensus goals to facilitate follow-up discussions and broader collaboration within the RLIHT community.

Çetin Meriçli (chair), Brenna D. Argall, Maya Çakmak, W. Bradley Knox, and Tekin Meriçli served as the organizing committee for this symposium.

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