

# **Coordination of Robot Teams in Adversarial Environments**

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## **ABSTRACT**

In recent years, many researchers have invested significant effort on investigating multi-robot systems. Robot soccer, as a pioneering multi-robot task, has offered a challenging research testbed. In robot soccer, a team of multiple robots faces a uncertain and dynamic environment created by a team of opponent robots.

We have researched in robot soccer developing single-robot and multi-robot perception, cognition, and action algorithms. To form an effective team of robots, individual robots need to be robust. We have developed effective object recognition, localization, and behavior-based algorithms. In addition, to achieve a reliable team of robots, we need to research on team coordination strategies, team response to a dynamic world, behavior recognition, opponent modeling, and multiagent learning. In this talk, I will present on our contributions to these multi-robot issues, focusing on our team of communicating Sony four-legged AIBO robots, which is the current RoboCup'2002 world champion.

Communication among a group of robots should in principle improve the performance of the overall team of robots, as robots may share their world views and may negotiate task assignments. However, in practice, effectively handling in real-time multi-robot merge of information and coordination is a challenging task. I will present our contributions in creating effective approaches for maintaining a shared world model and using it as a basis for coordinating multiple robots. Our approach further involves creating shared potential functions based on shared positions of relevant obstacles in the world. The biases introduced in the potential functions are general enough that they could even be provided by external sources, such as a learner, human or robot coach. We provide controlled experiments to analyze the impact of our approach in the overall performance of a robot team.

I will conclude setting my research goals in perspective and discussing some of the fascinating open questions to be addressed towards creating teams of truly autonomous robots.

