



**The Center for Control, Dynamical Systems, and Computation
University of California at Santa Barbara
Spring 2008 Seminar Series
Presents**

Noncooperative Cooperation

**Jason Marden
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Friday, April 18, 2008 3:00-4:00pm Harold Frank Hall 1104

Abstract:

In this talk, we present a view of cooperative control using the language of learning in games. We review the game theoretic concept of potential games and demonstrate how several cooperative control problems such as routing, rendezvous, and sensor coverage can be formulated in this setting. Motivated by this connection, we build upon learning in games to better accommodate a broader class of cooperative control problems. The theory of learning in games has sought to understand how and why equilibria emerge in non-cooperative games. Traditionally, economists develop descriptive behavioral models, analyze the limiting behavior, and generalize the results for large classes of games. In contrast, our focus is on exploiting these models from a prescriptive point of view, i.e., as adaptive algorithms for large scale distributed systems. This paradigm shift leads to many challenging problems. For example, in large scale systems many well known distributed learning algorithms that guarantee convergence to an equilibrium, such as Fictitious Play, are prohibitive in their informational and computational requirements. Accordingly, we will focus on the development of learning algorithms with minimal computational requirements to accommodate implementation in a wide variety of engineered systems. We will also discuss an extension to existing learning algorithms that accommodates restricted action sets caused by limitations in agent capabilities. Lastly, we illustrate the potential benefits of this connection on several cooperative control problems. For the rendezvous problem, we demonstrate that rendezvous can be reached in an environment with non-convex obstructions. For the sensor coverage problem, we demonstrate how autonomous sensors can distribute themselves using only local information to maximize the probability of detecting an event over a given mission space. Lastly, to fully elucidate the broad applicability of these results, we demonstrate how these methods can be used as a distributed algorithm for the popular puzzle Sudoku.

Abstract:

Jason Marden's research interest is game theoretic methods for feedback control of distributed multi-agent systems. He received a BS in Mechanical Engineering in 2001 from UCLA, and a PhD in Mechanical Engineering in 2007, also from UCLA, under the supervision of Jeff S. Shamma. Since 2007, he has been a junior fellow in the Social and Information Sciences Laboratory at the California Institute of Technology.