Economics Seminar, Indian Statistical Institute, New Delhi

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Title: Reinforcement Learning in Evolutionary Games functions

Day and Date: 11:30 AM, Friday, 10th December, 2010

Venue: Seminar Room 2, ISI Delhi

Abstract

We study an evolutionary model in which strategy revision protocols are based on agent specific characteristics rather than wider social characteristics. We assume that agents are primed to play a mixed strategy, with the weights on each pure strategy modifiable on the basis of experience. At any time, the distribution of mixed strategies over agents in a large population is described by a probability measure on the space of mixed strategies. In each round, a pair of randomly chosen agents play a symmetric game, after which they update their mixed strategies using a reinforcement learning rule based on payoff information. The resulting change in the distribution over mixed strategies is described by a non-linear continuity equation - in its simplest form a first order partial differential equation associated with the classical replicator dynamics. We provide a general solution to this equation in terms of solutions to an associated finite-dimensional dynamical system. We use these results to study in detail the evolution of mixed strategies in various classes of symmetric games, and in a simple model of price dispersion. A key finding is that, when agents carry mixed strategies, distributional considerations cannot be subsumed under a classical approach such as the deterministic replicator dynamics.