İSTANBUL ANALYSIS SEMINARS

Approximate Nash Equilibria in Mean-Field Games with Discounted Cost

NACİ SALDI

Özyeğin University
Department of Natural and Mathematical Sciences

Abstract: In this talk, I will present a general theory for discrete-time mean-field games with discounted infinite-horizon cost. I will cover both perfect state and partial state information structures. The state space of each player is a Polish space, and at each time, the players are coupled through the empirical distribution of their states, which affects both the players individual costs as well as their state transition probabilities. I will first discuss the difficulties to be encountered in any attempt to obtain the exact Nash equilibrium in such dynamic games with decentralized information, with a finite number of players. The mean-field approach offers a way out of this difficulty. First focusing on the perfect state information, and using the solution concept of Markov-Nash equilibrium, I will show under some mild conditions the existence of a mean-field equilibrium in the infinite population limit. I will then show that the policy obtained from the mean-field equilibrium is approximately Markov-Nash when the number of players is sufficiently large. Following this, I will turn to the class of discrete-time partially observed mean-field games. Using the technique of converting the original partially observed stochastic control problem to a fully observed one on the belief space and the dynamic programming principle, I will establish the existence of Nash equilibria under mild technical conditions. I will again show, as in the perfect state information case, that the mean-field equilibrium policy, when adopted by each player, forms an approximate Nash equilibrium for games with sufficiently many players.

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