Players as serial or parallel random access machines

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Abstract

In data-rich dynamic games—such as when players choose multidimensional actions, when there are many players, or when payoffs are affected by multidimensional state variables—players need to process information to adapt to exogenous shocks and to predict the actions of other players. In such games, computationally-constrained players can be well-modelled as serial or parallel random access machines. Such a model of complexity is more powerful and richer than, say, finite automata. It captures the difficulty players have in keeping up with changing actions and environmental variables. Parallel computation allows one to model players that are organizations. The purpose of this paper is to explore this methodology in some abstract examples and somes games from industrial organization. We consider, for example, whether investments in computation power are strategic complements and whether information processing constraints lead to asymmetries, with players specializing heterogenously in the information that they process. We also characterize the equilibrium of a game in which players compete to better forecast stochastic processes and each player is modeled as a parallel-processing organization.