Learning and Stability in Repeated Games of Incomplete Information

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Extended abstract

A game is Bayesian, if players have private information about their own types, describing information that is known to themselves but not to their opponents. Bayesian equilibrium is Nash equilibrium of a Bayesian game.
Due to their broad applicability, for several decades Bayesian equilibria have been a major subject of study among researchers and users of game theory.

Two established observations about Bayesian equilibria are the following:
1. Learning in repeated play. The play of any Bayesian equilibrium in a repeated game with initially unknown private types must converge to the play of a Nash equilibrium in which the types have become common knowledge. In other words, essential private information is learned with time (see Kalai and Lehrer Econometrica 1993).
2. Robustness in one-shot games with many players. The Bayesian equilibria of one-shot Bayesian games become highly robust as the number of players increases. More specifically, equilibrium strategies remain at equilibrium even if the game is altered to allow for repeated revisions of choices, information leakage, delegation of choices and more (see Kalai Econometrica 2004).

While the properties above have strong implications in economics, political science, computer science and other fields, their applicability is limited because of restrictive assumptions, for examples that the individual types are statistically independent.
Current studies of the presenters deals with
3. **Learning and stability in Bayesian repeated games with many players**.
Bayesian games that combine the features of (1) and (2) above, namely they are played repeatedly and by many players, do not suffer from restrictions described above. But Bayesian equilibria of such games are too complex to analyse. To overcome this difficulty the researchers use a new simpler notion called *compressed* e*quilibrium*. Despite its simplicity, this equilibrium has the following useful properties: (A) It provides a good approximation for real Bayesian equilibria when the number of players is large, and it shows (B) that at Bayesian equilibrium the number of unstable periods of play is bounded (See Kalai and Shmaya 2013).
The lectures provide details on items 1-3 above.