Pre-Bayesian Games

Moshe Tennenholtz
Technion–Israel Institute of Technology

Abstract

Work on modelling uncertainty in game theory and economics almost always uses Bayesian assumptions. On the other hand, work in computer science frequently uses non-Bayesian assumptions and appeal to forms of worst case analysis.

In this talk we deal with Pre-Bayesian games, games with incomplete information but with no probabilistic assumptions about the environment. We first discuss safety-level, minmax regret, and competitive ratio equilibria, and their existence in a general setting. Our study then concentrates on safety-level equilibrium and its use when incorporating uncertainty into congestion settings. In particular, we show that the lack of knowledge on the number of participants is beneficial to the society in any linear resource selection game. Next we introduce efficient learning equilibrium [ELE], a form of ex-post equilibrium for Pre-Bayesian repeated (and more generally, stochastic) games. ELE is a solution concept for learning in games, where the learning algorithms themselves are required to be in equilibrium for a whole class of games. We prove the (constructive) existence of ELE for some rich settings.

The talk will be a brief and somewhat informal introduction to our work on Pre-Bayesian games. The particular results which will be presented are based on joint work with Itai Ashlagi, Ronen Brafman, and Dov Monderer.

References

[1] I. Ashlagi, D. Monderer, and M. Tennenholtz. Resource Selection Games with Unknown Number of Players. Proceedings of the 5th International Joint Conference on Autonomous Agents and Multiagent Systems, 2006.

[2] I. Ashlagi, D. Monderer, and M. Tennenholtz. Robust learning equilibrium. Proceedings of UAI-06, 2006.

[3] I. Ashlagi, D. Monderer, and M. Tennenholtz. Routing Games with an Unknown Set of Active Players. Technion working paper, 2006.

[4] R. Brafman and M. Tennenholtz. Optimal efficient learning equilibrium: Imperfect monitoring in symmetric games. In *Proceedings of AAAI-2005*. AUAI Press, 2005.

[5] R. I. Brafman and M. Tennenholtz. R-max – a general polynomial time algorithm for near-optimal reinforcement learning. *Journal of Machine Learning Research*, 3:213–231, 2002.

[6] R. I. Brafman and M. Tennenholtz. Learning to coordinate efficiently – a model based approach. *Journal of Artificial Intelligence Research*, 19:11–23, 2003.

[7] R. I. Brafman and M. Tennenholtz. Efficient learning equilibrium. *Artificial Intelligence*, 159:27–47, 2004.