Learning in Stochastic Games

Supervision by Rida Laraki (Lamsade) & Guillaume Vigeral (Ceremade)

Learning equilibria of a static game G after playing it repeatedly is a subject that has been widely studied almost since the beginning of game theory. One of the ways to construct such algorithms is through regret learning, or equivalently approachability. In contrast, learning Nash equilibria of a dynamic model such as a stochastic game has comparatively been much less developed. The last years have seen many contributions and algorithms that aim to learn stationary Nash equilibria in some sub models of stochastic games (zero-sum and identical interest stochastic games). Few results have been obtained outside these two classes, or with other notions of equilibria (such as correlated equilibria), or about the last iterate convergence even in this two classes.

Some possible objectives/directions of this PhD thesis are:

- Design new algorithms that learn (correlated, or coarse correlated) stationary equilibria in general stochastic games.
- Design algorithms that spend most of the time close to a pure stationary Nash equilibrium is a stochastic game (whenever it exists).
- Improve the existing algorithms in stochastic games by requiring less information, a better speed of convergence, or a last iterate convergence.
- Extend Blackwell Approachability and Regret Learning to Stochastic Games.

Références

Baudin, Laraki. Fictitious Play and Best-Response Dynamics in Identical-Interest and Zero-Sum Stochastic Games. https://arxiv.org/pdf/2111.04317.pdf, accepted in ICML 2022, May 2022.

Baudin, Rida Laraki (2022). Smooth Fictitious Play in Stochastic Games with Perturbed Payoffs and Unknown Transitions. https://arxiv.org/pdf/2207.03109.pdf

Flesch, Laraki, Perchet (2018). Online Learning and Blackwell Approachability in Quitting Games, Games and Economic Behavior. https://arxiv.org/abs/1609.08870v1

Hadikhanloo, Laraki, Mertikopoulos, Sorin (2022). Learning in nonatomic games, part Ⅰ: Finite action spaces and population games. Journal of Dynamics and Games. https://www.aimsciences.org/article/doi/10.3934/jdg.2022018

Daskalakis, Foster, Golowich (2020). Independent policy gradient methods for competitive reinforcement learning. Neurips 2020. URL https://proceedings.neurips.cc/paper/2020/file/3b2acfe2e38102074656ed938abf4ac3-Paper.pdf.

Perchet (1014), Approachability, regret and calibration: Implications and equivalences, Journal of Dynamics & Games, https://www.aimsciences.org/article/doi/10.3934/jdg.2014.1.181