ZITENG CHENG, University of Toronto

Mean field regret in discrete time games

We use mean field games (MFGs) to investigate approximations of N-player games with uniformly symmetrically continuous heterogeneous closed-loop actions. To incorporate agents' risk aversion (beyond the classical expected utility of total costs), we use an abstract evaluation functional for their performance criteria. Centered around the notion of regret, we conduct non-asymptotic analysis on the approximation capability of MFGs from the perspective of state-action distributions without requiring the uniqueness of equilibria. Under suitable assumptions, we first show that scenarios in the N-player games with large N and small average regrets can be well approximated by approximate solutions of MFGs with relatively small regrets. We then show that δ-mean field equilibria can be used to construct ε-equilibria in N-player games. Furthermore, in this general setting, we prove the existence of mean field equilibria (MFEs). Our analysis above reveals an approximated refinement of N-player equilibria through MFEs. It also offers theoretical substantiation for algorithms that identify MFEs by minimizing regrets.