



A Primal Condition for Approachability with Partial Monitoring

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In approachability with full monitoring there are two types of conditions that are known to be equivalent for convex sets: a primal and a dual condition. The primal one is of the form: a set C is approachable if and only all containing half-spaces are approachable in the one-shot game; while the dual one is of the form: a convex set C is approachable if and only if it intersects all payoff sets of a certain form. We consider approachability in games with partial monitoring. In previous works (Perchet 2011; Mannor et al. 2011) we provided a dual characterization of approachable convex sets; we also exhibited efficient strategies in the case where C is a polytope. In this paper we provide primal conditions on a convex set to be approachable with partial monitoring. They depend on a modified reward function and lead to approachability strategies, based on modified payoff functions, that proceed by projections similarly to Blackwell's (1956) strategy; this is in contrast with previously studied strategies in this context that relied mostly on the signaling structure and aimed at estimating well the distributions of the signals received. Our results generalize classical results by Kohlberg 1975 (see also Mertens et al. 1994) and apply to games with arbitrary signaling structure as well as to arbitrary convex sets.

Subjects: **Optimization and Control (math.OC)**; Computer Science and Game Theory (cs.GT); Learning (cs.LG); Machine Learning (stat.ML)

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