

# Data-driven interdiction with asymmetric cost uncertainty: a distributionally robust optimization approach

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We consider a class of stochastic interdiction games between an upper-level decision-maker (referred to as a *leader*) and a lower-level decision-maker (referred to as a *follower*), where the follower's objective function coefficients are subject to uncertainty.

More specifically, unlike traditional deterministic interdiction problem settings, the follower's profits (or costs) in our model comprise a random vector, whose probability distribution is estimated independently by the leader and by the follower, based on their own data. In order to address the distributional uncertainty, we formulate a Wasserstein distributionally robust interdiction (DRI) problem, where both decision-makers attempt to hedge against the worst-case distributions and realizations of the follower's objective function coefficients. If the leader has full information about the follower's data, then the DRI problem with properly defined Wasserstein ambiguity sets and objective criteria is shown to admit a single-level mixed-integer linear programming (MILP) reformulation of polynomial size. In contrast, when the leader has incomplete or no information about the follower's data, we propose two distinct approaches for approximating the DRI problem. The first approach employs a pessimistic approximation, which turns out to be computationally challenging and requires the design of a specialized Benders decomposition algorithm. The second approach leverages a finite set of candidate data sets that satisfy prescribed interval constraints and addresses the resulting problem via a one, potentially large single-level MILP reformulation. Finally, for a class of randomly generated instances of the packing interdiction problem, we evaluate numerically how the information asymmetry and the decision-makers' risk preferences affect the model's out-of-sample performance.

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