On Distributionally Robust Chance Constrained Programs with Wasserstein Distance

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This paper studies a distributionally robust chance constrained program (DRCCP) with Wasserstein ambiguity set, where the uncertain constraints should be satisfied with a probability at least a given threshold for all the probability distributions of the uncertain parameters within a chosen Wasserstein distance from an empirical distribution. In this work, we investigate equivalent reformulations and approximations of such problems. We first show that a DRCCP can be reformulated as a conditional value-at-risk constrained optimization problem, and thus admits tight inner and outer approximations. We also show that a DRCCP of bounded feasible region is mixed integer representable by introducing big-M coefficients and additional binary variables. For a DRCCP with pure binary decision variables, by exploring the submodular structure, we show that it admits a big-M free formulation and can be solved by a branch and cut algorithm. Finally, we present a numerical study to illustrate the effectiveness of the proposed formulations.