From Discretization to Duality in Infinite Optimization

Abderrahim Hantoute[1]

[1]University of Alicante, Alicante, Spain

Abstract

We propose a general framework in which optimization problems involving infinitely many constraints can be reduced to families of finite subproblems without altering the optimal value. More precisely, under suitable assumptions, we show that the value of the original problem can be recovered as a limit (or envelope) of the values associated with finite subsets of constraints. The analysis is based on perturbation methods combined with compactness arguments. Particular attention is given to the convex—and, in some cases, quasi-convex—setting, where linear perturbations suffice in place of quadratic ones. Additional simplifications arise in finite-dimensional settings, or when dealing with standard optimization problems with finitely many constraints. These reductions are especially useful, as they enable the application of compactness, duality, and minimax techniques within a more tractable framework.