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Preference robust optimization

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Preference robust optimization (PRO) is a relatively new area of robust optimization. In this talk, I give an overview of recent research on utility-based PRO models and computational methods primarily conducted by my collaborators and myself over the past few years. I begin with a description on one-stage maximin utility PRO model where the true utility function representing the decision maker's (DM's) preferences on rewards is ambiguous, discuss how an ambiguity set of utility functions may be constructed based on partially available information, and how such a maximin optimization problem may be efficiently solved. Next, I introduce a multistage PRO model where the DM's true utility function is historically path dependent and discuss various issues concerning derivation of recursive formulation and numerical solution of the problem via SDDP. One of the main issues to be emphasized is the rectangularity of the ambiguity set of utility functions which underlies the dynamic formulation of the multistage PRO model. To reduce the conservatism of the PRO models, I move on to introduce the main existing approaches which are used to elicit a DM's preference including relative utility split (RUS) method, random relative utility split (RRUS) method, maximum utility split (RUS) method and polyhedral cut method. These methods are used to design questionnaires for pairwise comparison and subsequently to reduce the size of ambiguity set once a choice is made by the DM. Finally, I extend the discussions to other PRO models including bi-variate utility PRO model, distributionally robust utility preference model when a DM's preferences are random and PRO models with target/benchmark. The materials of this talk are mostly extracted from my joint papers with Guo and Zhang (2024), Liu and Chen (2025), Zhang, Guo and Sim (2025), Chen and Liu (2025), Haskell and Wu (2025), Hu, Zhnag and Zhang (2024), Wu, Wang and Zhang (2024) as well as other references papers particularly Armbruster and Delage (2015) and Hu and Mehotra (2015).

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