Active Preference Elicitation via Adjustable Robust Optimization

**Abstract:** We are motivated by the problem of designing policies for prioritizing individuals experiencing homelessness for scarce housing resources in a way that meets the value judgements of policymakers. We elicit stakeholder preferences over policy characteristics by using a moderate number of pairwise comparisons, in the spirit of conjoint analysis. We investigate: a) an offline elicitation setting, where all queries are made at once, and b) an online elicitation setting, where queries are selected sequentially over time. We propose exact robust optimization formulations of these problems which integrate the elicitation and recommendation phases and study the complexity of these problems. For the offline case, where the problem takes the form of a two-stage robust optimization problem with decision-dependent information discovery, we provide an equivalent reformulation in the form of a mixed-binary linear program which we solve via column-and-constraint generation. For the online setting, we propose a conservative solution approach. We evaluate the performance of our methods on both synthetic data and real data from the Homeless Management Information System. Our numerical experiments on both synthetic data and real data from the Homeless Management Information System show that our framework outperforms the state-of-the-art techniques from the literature.

**Biography:** Phebe Vayanos is an Assistant Professor of Industrial & Systems Engineering and Computer Science at the University of Southern California. She is also an Associate Director of CAIS, the Center for Artificial Intelligence in Society, an interdisciplinary research initiative between the schools of Engineering and Social Work at USC. Her research is focused on Operations Research and Artificial Intelligence and in particular on optimization and machine learning. Her work is motivated by problems that are important for social good, such as those arising in public housing allocation, public health, and biodiversity conservation. Prior to joining USC, she was lecturer in the Operations Research and Statistics Group at the MIT Sloan School of Management, and a postdoctoral research associate in the Operations Research Center at MIT. She holds a PhD degree in Operations Research and an MEng degree in Electrical & Electronic Engineering, both from Imperial College London. She served as a member of the ad hoc INFORMS AI Strategy Advisory Committee and is an elected member of the Committee on Stochastic Programming (COSP). She is a recipient of the INFORMS Diversity, Equity, and Inclusion Ambassador Program Award.

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