Can we ensure fairness and efficiency when preferences are uncertain?

Resource Allocation under Uncertainty (RAU)

Given \( n \) agents \( N \), partitioned into groups \( G \), with \( m \) goods \( M \) Additive, unknown utilities \( U^* \in \mathcal{U} \) w.h.p.

Select allocation \( A \in \mathcal{A} \) \((0,1)^{m \times n} + \) additional constraints) such that welfare \( W(A, U^*) \) is maximized

Constructing Uncertainty Sets

Transductive Predictors
Construct \( \hat{U} \) from samples of \( U^* \)

Inductive Predictors
Construct \( \hat{U} \) using past data

Intersecting & Expanding Uncertainty Sets

Robust Resource Allocation (RRA)

Solving RAU

RAU is NP-hard for USW under finite convex combinations of linear half-spaces (reduction from max egalitarian reviewer assignment)

Robust Social Welfare (USW)
Maximize

Robust G-ESW
Maximize

Objectives

Utilitarian Social Welfare (USW)

Group Egalitarian Social Welfare (G-ESW)

Case Study: Reviewer Assignment

In presence of noisily-estimated papers/reviewers, RRA performs better on hidden "true" USW

RRA has strong worst-case USW on recent ICLR’s

RRA also improves “true” USW and G-ESW for ICLR

Although RRA may have to round significantly, we obtain high probability lower bounds on \( W(A, U^*) \)

Read it on arxiv!