Poster RJCIA

Simultaneous Elicitation of Committee and Voters' Preferences

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Scenario

Incompletely specified profile and positional scoring rule

Goal

Development of query strategies interleaving questions to the committee and to the voters in order to simultaneously elicit preferences and voting rule

Motivation and approach

Who?

- Imagine to be an *external observer* helping with the voting procedure

Why?

- Voters: difficult or costly to order *all* alternatives
- Committee: difficult to *specify* a voting rule precisely and abstractly

How?

- *Minimax regret*: given the current knowledge, the alternatives with the lowest worst-case regret are selected as tied winners

Context

- A Alternatives: $|A| = m$
- N Voters: determine a complete preferences profile $P = (\succ_j,\ j \in N),\ P \in \mathcal{P}$
- Committee: has a (convex) scoring vector in mind $W = (\boldsymbol{w}_r,\ 1 \leq r \leq m),\ W \in \mathcal{W}$
- W defines a Positional Scoring Rule $f_W(P) \subseteq A$ using scores $s^{W,P}(a),\ \forall\, a \in A$

Questions

P and W exist but they are unknown to us. They can be elicited by asking:

- **Questions to the voters**

  Comparison queries that ask a particular voter to compare two alternatives $a, b \in A$

  $$a \succ_j b \quad ?$$

- **Questions to the committee**

  Queries relating the difference between the importance of ranks r to $r+2$

  $$w_r - w_{r+1} \geq \lambda(w_{r+1} - w_{r+2}) \quad ?$$

Our Knowledge

The answers to these questions define C_P and C_W that is our knowledge about P and W

- $C_P \subseteq \mathcal{P}$ constraints on the profile given by the voters
- $C_W \subseteq \mathcal{W}$ constraints on the voting rule given by the committee

Elicitation strategies

Given our knowledge so far, what is the next question that should be asked?

- **Random**: it decides, with $1/2$ probability, whether to ask a question to the voters or to the committee, then it equiprobably draws one among the set of the possible questions;
- **Extreme completions**: it asks a question to the committee or to the voters depending on which uncertainty contributes the most to the regret;
- **Pessimistic**: it selects the question that leads to minimal regret in the worst case considering, and aggregating, both possible answers to each question;
- **Two phase**: it asks a predefined, non adaptive sequence of $m-2$ questions to the committee and then it only asks questions about the voters.

Minimax Regret

Given $C_P \subseteq \mathcal{P}$ and $C_W \subseteq \mathcal{W}$:

the pairwise max regret $\mathrm{PMR}^{C_P,C_W}(a,b) = \max_{P \in C_P, W \in C_W} s^{P,W}(b) - s^{P,W}(a)$ is the maximum difference of score between a and b under all possible realizations of the full profile *and* weights

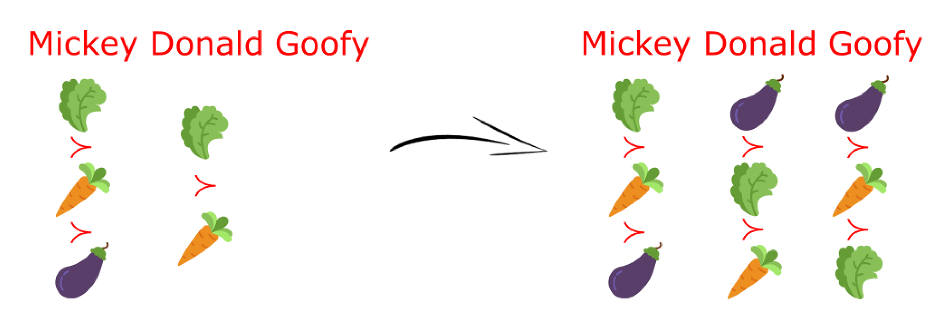
We care about the worst case loss: *maximal regret* between a chosen alternative a and best real alternative b.

We select the alternative which *minimizes* the maximal regret

Pairwise Max Regret Computation

The computation of $\mathrm{PMR}^{C_P,C_W}(\ ,\ )$ can be seen as a game in which an adversary

- **chooses a complete profile $\mathbf{P} \in \mathcal{P}$**



- **chooses a feasible weight vector $\mathbf{W} \in \mathcal{W}$**

  $$(\mathbf{1}, ?, \mathbf{0}) \longrightarrow (\mathbf{1}, \mathbf{0}, \mathbf{0})$$

in order to maximize the difference of scores.

References

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