Simultaneous Elicitation of Committee and Voters' Preferences

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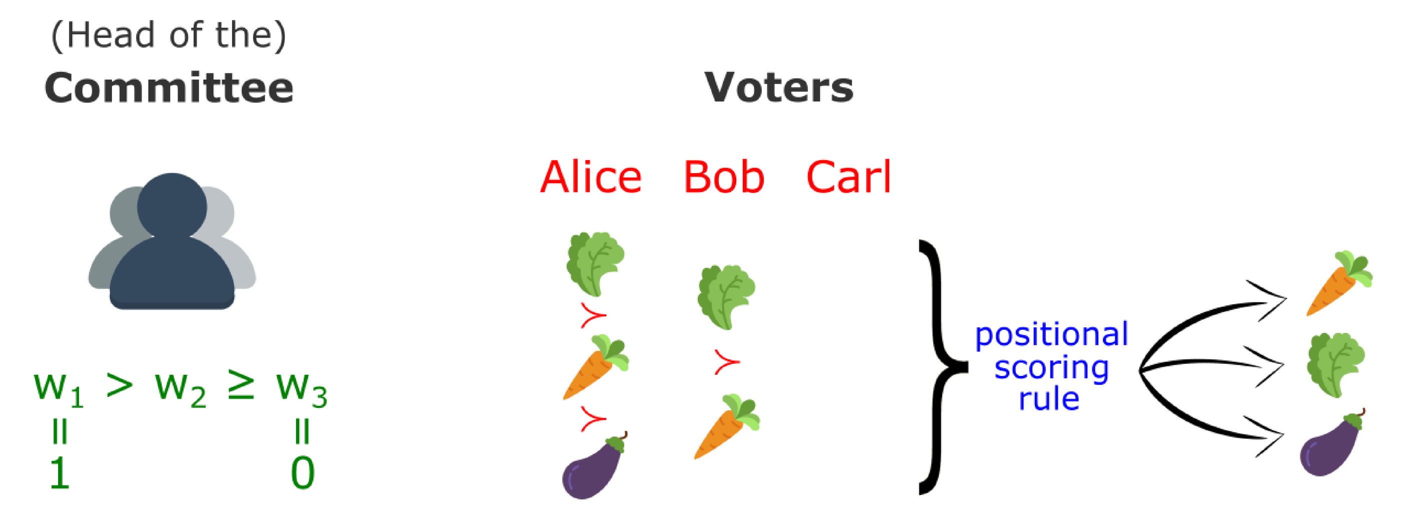
Scenario

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

Assumptions

- Voters and committee have true preferences in mind
- The voting rule is a Positional Scoring Rule where the scoring vector $\boldsymbol{w} = (w_1, \dots, w_m)$ is a convex sequence of weights and $w_1 = 1$, $w_m = 0$

Framework

$\lvert N\rvert = n, \lvert A\rvert = m$	voters, alternatives
$\succ^p_j$	partial preference order of the voter $j \in N$
$\mathcal{C}_W$	set of linear constraints given by the committee about $\boldsymbol{w}$

Given complete voters preferences $\boldsymbol{v}$, a specific positional scoring rule, defined by a scoring vector $\boldsymbol{w}$, attributes a score $s^{\boldsymbol{v},\boldsymbol{w}}$ to each alternative.

Minimax Regret

Given partially specified positional scoring rule and voters preferences

the pairwise max regret $\mathrm{PMR}^{\boldsymbol{p},W}(x, y)$ is the maximum difference of score between x and y under all possible realizations of the full profile *and* weights.

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

We select the alternative which *minimizes* the maximal regret

Question Types

Questions to the voters

Comparison queries that ask a particular voter to compare two alternatives

$$x \succ_j y \quad ?$$

Questions to the committee

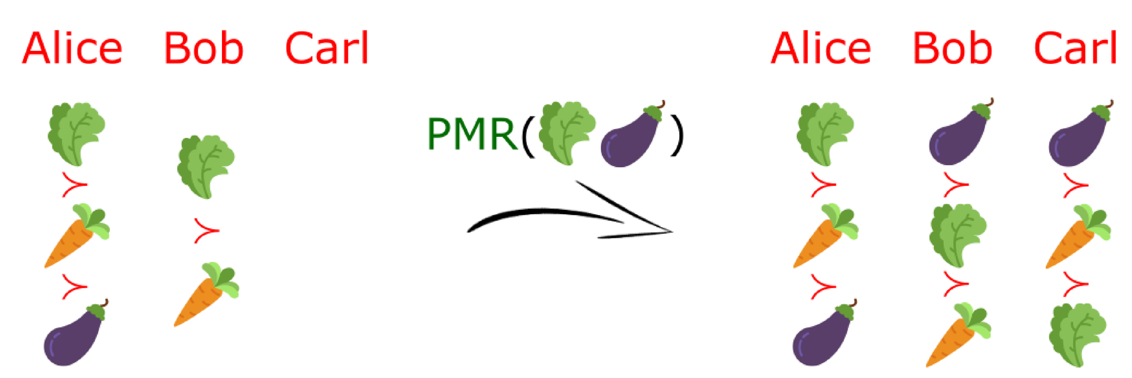
Queries relating the difference between the importance of consecutive ranks r and $r+1$

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

Pairwise Max Regret Computation

The computation of $\mathrm{PMR}^{\boldsymbol{p},W}(x, y)$ can be seen as a game in which an adversary can both

- **complete the partial profile**



- **choose a feasible weight vector**

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

in order to maximize the difference of scores.

Elicitation strategies

A function that, given our partial knowledge so far, returns a 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.

References

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