

SIMULTANEOUS ELICITATION OF COMMITTEE AND VOTERS' PREFERENCES

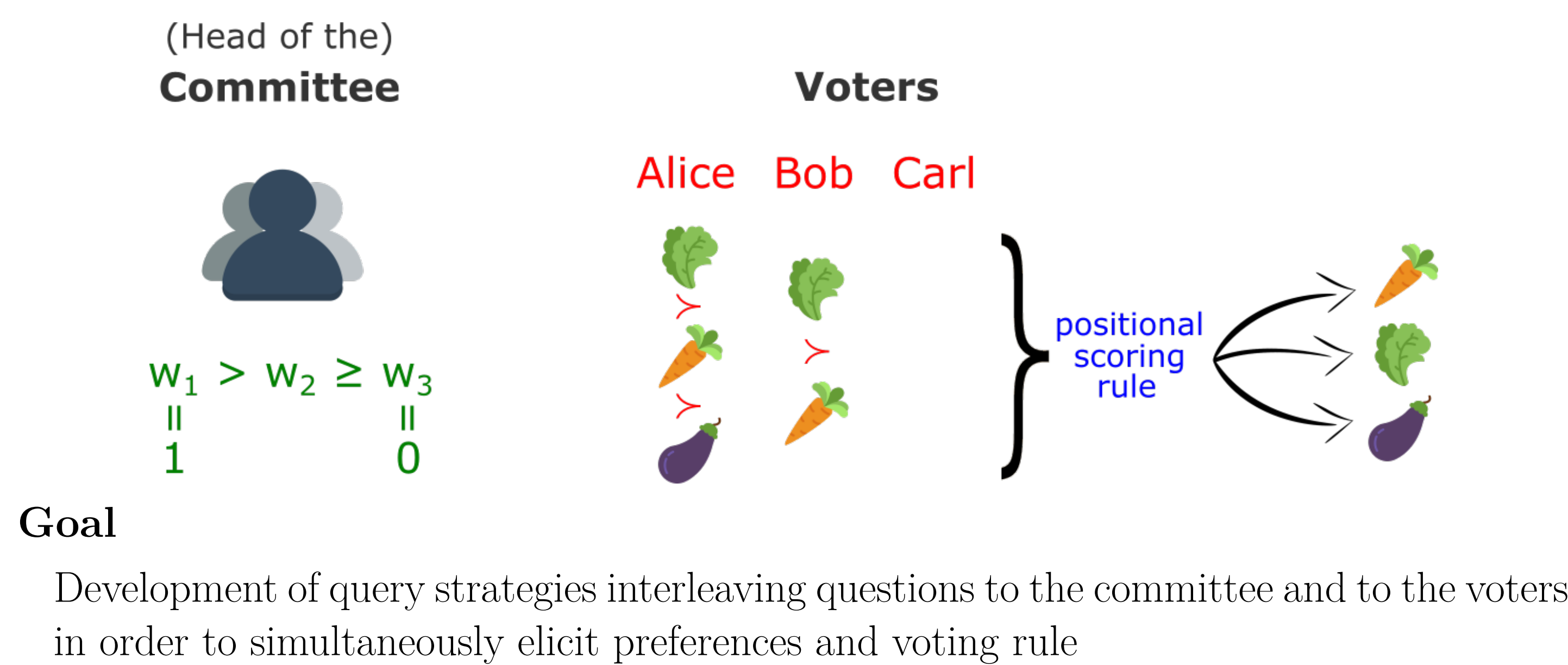
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Scenario

Incompletely specified profile and positional scoring 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 (w_1, \dots, w_m) is a convex sequence of weights and $w_1 = 1, w_m = 0$

Framework

$|N| = n, |A| = m$ voters, alternatives

$v_j = \succ_j$ real preference order of the voter $j \in N$

$V = \{v \mid v = (v_1, \dots, v_n)\}$ set of complete preference profiles

$W = \{w \mid w = (w_1, \dots, w_m)\}$ set of scoring vectors

$s^{v,w}(x) = \sum_{j \in N} w_{v_j(x)}$ score of alternative x under the profile v and weights w

\succ_j^p partial preference order of the voter $j \in N$

$C(\succ_j^p) = \{\succ \mid \succ_j^p \subseteq \succ\}$ set of possible completions of \succ_j^p

\mathcal{C}_W set of linear constraints given by the committee about w

Question Types

Questions to the voters

Comparison queries that ask a particular voter to compare two alternatives

$$a \succ_j b \quad ?$$

Questions to the committee

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

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

Minimax Regret

$$\text{Regret}^{v,w}(x) = \max_{y \in A} s^{v,w}(y) - s^{v,w}(x)$$

is the regret of selecting x as a winner instead of the optimal alternative under v and w

$$\text{PMR}^{p,W}(x, y) = \max_{w \in W} \max_{v \in C(p)} s^{v,w}(y) - s^{v,w}(x)$$

is the worst-case loss of choosing x instead of y

Max regret $\text{MR}^{p,W}(x)$ is the worst-case loss of x and the minimal max regret $\text{MMR}^{p,W}$ is the regret associated to an optimal alternative.

Pairwise Max Regret Computation

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

- complete the partial profile**



- choose a feasible weight vector**

$$(1, 0, 0)$$

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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