

SIMULTANEOUS ELICITATION OF COMMITTEE AND VOTERS' PREFERENCES

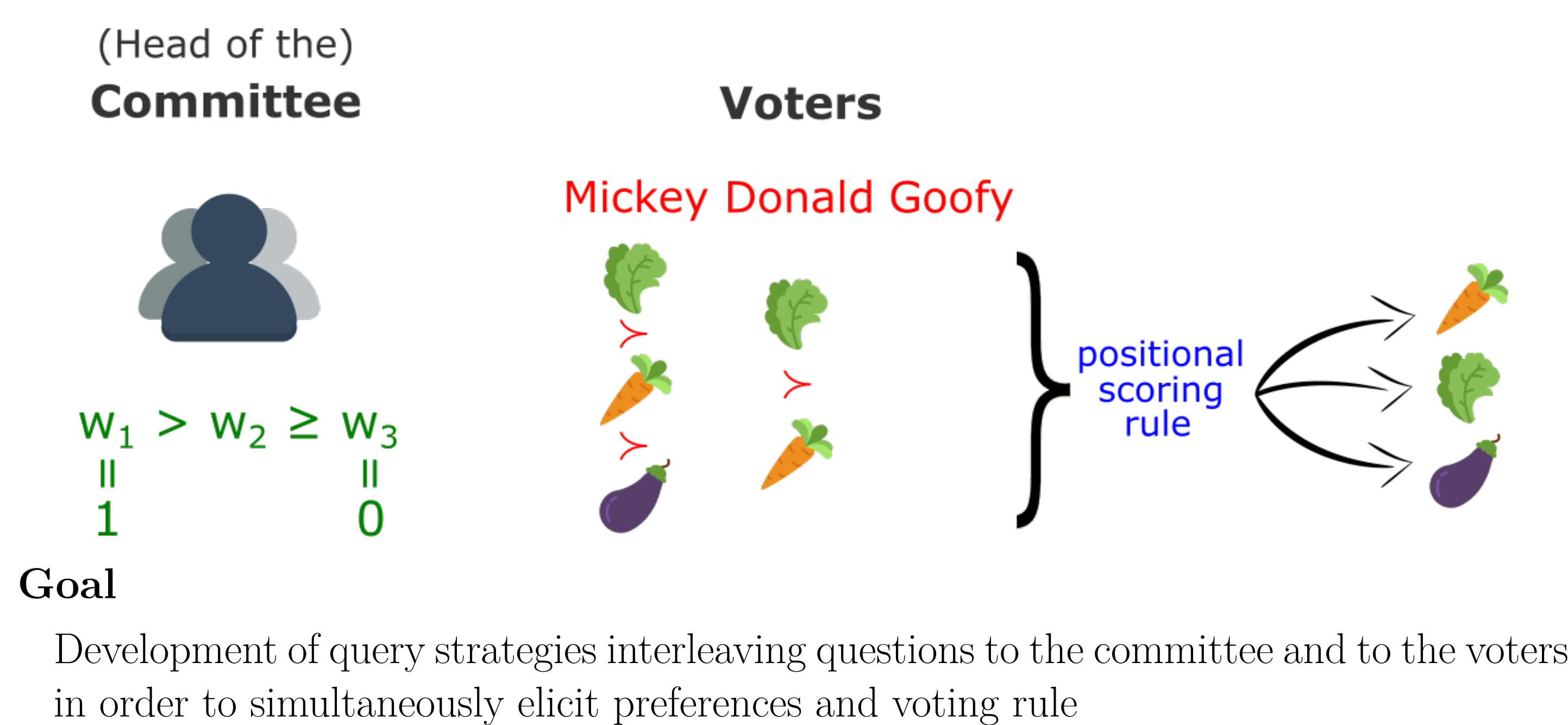
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Scenario

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

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 $W = (w_r, 1 \leq r \leq m)$, $W \in \mathcal{W}$
- 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

Minimax Regret

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

the pairwise max regret $\text{PMR}^{C_P, C_W}(a, b) = \max_{P \in C_P, W \in C_W} s^{P, W}(b) - s^{P, W}(a)$ 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

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.

References

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- [2] T. Lu and C. Boutilier. Robust approximation and incremental elicitation in voting protocols. In *Proceedings of IJCAI 2011*, pages 287–293, 2011.
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- [4] Kalech, M., Kraus, S., Kaminka, G. A., and Goldman, C. V. (2011). Practical voting rules with partial information. *Autonomous Agents and Multi-Agent Systems*, 22(1):151–182.

Pairwise Max Regret Computation

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

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



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

$$(1, ?, 0) \rightarrow (1, 0, 0)$$

in order to maximize the difference of scores.