Information, interaction and manipulation in voting

Summary of the PhD-thesis

INFORMATION, INTERACTION AND MANIPULATION IN VOTING

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This thesis is devoted to the problem of strategic behavior in voting and develops mathematical models of manipulation in several directions, each considered by a separate chapter. We reveal how the type of public information and voters' view of incentives of others influences manipulability of rules and studied the question of the safety of group manipulation.

The first question under consideration is coalitional manipulability under incomplete information. Coalition members are assumed to have identical preferences and all voters possess some information about a real preference profile from an opinion poll held before voting. We consider 5 different types of poll information functions. Manipulability is defined as the probability that in a randomly chosen preference profile there exists a coalition which has an incentive to manipulate under a given type of poll information. We calculate the degree of coalitional manipulability for 3 alternatives and the number of voters from 3 to 15 for different types of information and compare it with individual manipulability values. We study asymptotic behavior of manipulability for plurality and Borda rule under *1Winner* and *Winner*-PIFs theoretically and prove that for *1Winner*-PIF coalitional and individual manipulability of scoring rules coincide.

Suppose that manipulation is done by a group of voters who have the same preferences. If a voting result is more preferable for voters of this group provided that they all use the same strategy (report the same insincere preference), then each of them has an incentive to manipulate. However, due to the lack of information or communication some of group members may not manipulate. If there is a chance that they will become worse off in case only a subset of the whole group manipulates, then manipulation is unsafe. For several voting rules we find necessary and sufficient conditions on the numbers of voters and alternatives which allow for an unsafe manipulation or which make manipulation always safe.

Finally, we study individual manipulation under incomplete information and different assumptions about voters' beliefs about behavior of others. Since voters do not know preferences of others exactly, there is an uncertainty about the situation they are in. As earlier, incomplete information is modelled by poll information functions (PIFs). Voters that have an incentive to manipulate under PIF π are called π-manipulators. We consider three behavioral models. In the first model incentives to manipulation do not depend on other voters' incentives. In the second model each π-manipulator takes into account that all other π-manipulators strategise, and in the third model that only a subset of them do so. Therefore, the uncertainty about a situation is combined with uncertainty about other voters' actions. With the help of computations we reveal how the type of information and behavioral model influence the relative manipulability of 12 social choice rules. In theoretical results, we state and prove some propositions about the inheritance of zero manipulability from one model to another. And, finally, we prove that there is a certain number of voters starting from which manipulability of a scoring rule is zero with public information about a winner after tie-breaking.