Recent Trends in Computational Social Choice

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Abstract

People often need to arrive at a collective decision about a subject on which they have different opinions. *Voting* is a very common and natural method for such preference aggregation tasks. In a typical setting for voting, we have a set of alternatives or *candidates*, a set of agents called *voters* each of whom has an ordinal preference called votes over the candidates, and a voting rule which chooses one or a set of candidates as winner(s). We call a set of voters along with their preferences over a set of candidates and a voting rule an *election*.

With rapid improvement of computational power, the theory of voting has found its applications not only in decision making among human beings but also in aggregating opinions of computational agents. Indeed voting is commonly used whenever any system with multiple autonomous agents wishes to take a common decision. Common and classic applications of voting in multiagent systems in particular and artificial intelligence in general include collaborative filtering and recommender systems, planning among multiple automated agents, metasearch engine, spam detection, computational biology, winner determination in sports competition, similarity search and classification of high dimensional data etc. This extensive use of voting by computational agents makes the study of computational aspects of voting extremely important. In many applications of voting in artificial intelligence, one often has a huge number of voters and candidates. For example, voting has been applied in the design of meta search engines where the number of alternatives the agents are voting for is in the order of millions — the alternatives are the set of web pages in this case. In a commercial recommender system, for example Amazon.com, we often have a few hundred millions of users and items. In these applications, we need computationally efficient algorithms for quickly finding a winner of an election with so many candidates and voters.

Moreover, the very fact that the agents now have computational power at their disposal allows them to easily strategize their behavior instead of acting truthfully. For example, the problem of manipulation is much more severe in the presence of computational agents since the voters can easily use their computational power to find a manipulative vote. This makes the study of computational complexity of various strategic aspects in voting important. The field known as *computational social choice theory (COMSOC)* studies various computational aspects in the context of voting [BCE+15].

In this talk, we will survey about some of the exciting new research directions in Computational Social Choice. This will include preference elicitation [Con09], sampling based election prediction [DB15], and various campaign related problems [FHH06]. We will also discuss interesting trending concepts like liquid democracy [KMP18], participatory budgeting [FGM16], fairness in voting [CHV18], distortion of voting rules [CDK18], etc.

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