

The 1st international workshop on computational social choice

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Abstract

Computational social choice is a new discipline currently emerging at the interface of social choice theory and computer science. It is concerned with the application of computational techniques to the study of social choice mechanisms, and with the integration of social choice paradigms into computing. The first international workshop specifically dedicated to this topic took place in December 2006 in Amsterdam, attracting a mix of computer scientists, people working in artificial intelligence and multiagent systems, economists, game and social choice theorists, logicians, mathematicians, philosophers, and psychologists as participants.

1 What is computational social choice?

Computational social choice (Chevaileyre *et al.* 2007) is an interdisciplinary field of study at the interface of social choice theory and computer science, promoting an exchange of ideas in both directions. On the one hand, it is concerned with the application of techniques developed in computer science, such as complexity analysis or algorithm design, to the study of social choice mechanisms, such as voting procedures or fair division algorithms. On the other hand, computational social choice is concerned with importing concepts from social choice theory into computing. For instance, social welfare orderings originally developed to analyze the quality of resource allocations in human society are equally well applicable to problems in multiagent systems or network design.

Social choice theory is concerned with the design and analysis of methods for collective decision making. Much classical work in the field has concentrated on establishing abstract results regarding the existence (or otherwise) of procedures meeting certain requirements, but such work has not usually taken computational issues into account. For instance, classical results in voting theory show that, under some weak and very natural conditions, it is impossible to design a voting protocol that voters cannot manipulate by reporting insincere preferences when casting their ballots. A voting system that induces such insincere voting behaviour cannot be expected to reliably return the socially most preferable candidate as a winner. In recent years, computer scientists have started to analyze this kind of problem from a computational point of view (Faliszewski *et al.*, 2006). The basic idea is that, should it be the case that manipulating successfully is a computationally intractable problem, then manipulability may well be deemed an acceptable risk. In this sense, the computational perspective can (sometimes) allow us to overcome classical impossibility results.

Another example for the application of tools typically used in computer science to problems stemming from economics and social choice is the use of logic for the formal specification and verification, or more generally analysis, of social procedures. In the same way as computer scientists have long been using logic to formally specify the behaviour of computer systems, so as to allow for the automatic verification of certain desirable properties of such systems, suitable logics may

be used to specify social procedures such as voting protocols or fair division algorithms. This line of research is also known as *social software* (Parikh, 2002).

Known methods for collective decision making and classical results from social choice theory may not always be applicable when the number of alternatives from which to choose is large. This may, for instance, be the case when these alternatives have a combinatorial structure, as in negotiation over indivisible goods (where the number of bundles an agent may obtain is exponential in the number of goods) or committee elections (where the number of possible committees is exponential in the number of seats to be filled). For such combinatorial problems, the mere representation of the preferences of individuals over different alternatives becomes a non-trivial problem. A third example for work in computational social choice is then the application of techniques developed in artificial intelligence and logic for the compact representation of preferences to this kind of problem (Lang, 2004).

2 Report from the workshop

The 1st International Workshop on Computational Social Choice (COMSOC-2006) was hosted on 6–8 December 2006 by the Institute for Logic, Language and Computation (ILLC) at the University of Amsterdam. The workshop, which was sponsored by the NWO (the Dutch Research Council), the ILLC, the BRICKS project, and the BNVKI (the Belgian-Dutch Association for Artificial Intelligence), was attended by 80 participants from around the world: Austria, Canada, France, Germany, Israel, Italy, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Switzerland, the United Kingdom, and the United States.

The aim of organizing COMSOC-2006 had been to bring together different communities: computer scientists interested in computational issues in social choice; people working in artificial intelligence and multiagent systems who are using ideas from social choice to organize societies of artificial software agents; logicians interested in the logic-based specification and analysis of social procedures (social software); and last but not least people coming from social choice theory itself. And indeed, members of all these communities attended the workshop and presented their work.

The COMSOC-2006 programme consisted of five invited talks and the presentation of 38 contributed papers, selected from amongst the 48 submissions received by the programme committee. The invited talks were given by Francesca Rossi (Padova), Harrie de Swart (Tilburg), Noam Nisan (Jerusalem), Steven Brams (New York), and Boi Faltings (Lausanne).

In the morning of the first day, Francesca Rossi presented recent work of her group on preference aggregation in the presence of incomparable alternatives as well as uncertainty about the actual ordering of alternatives. In the afternoon, Harrie de Swart discussed an interdisciplinary approach to coalition formation and reported on the use of various software tools for computing stable governments. The second workshop day started with the invited talk by Noam Nisan, who gave an introduction to the field of algorithmic mechanism design. In particular, the talk provided an overview of results relating degrees of incentive compatibility and the efficiency of approximation schemes for solving multi-unit auctions. In the afternoon, Steven Brams spoke on fair division and discussed different procedures for dividing a cake amongst several people in ways that are both fair and efficient. On the final day, Boi Faltings discussed possibilities for achieving budget balance for social choice mechanisms, without creating incentives for manipulation amongst the agents involved.

Topics covered by the contributed talks included, amongst others, complexity-theoretic studies of voting rules; computational barriers to strategic behaviour; resource allocation and fair division; negotiation in multiagent systems; preference elicitation; ranking systems; logics for social choice; computational issues in coalition formation; mechanism design; and the study of social choice phenomena by means of simulation. The proceedings of COMSOC-2006 (Endriss & Lang, 2006), which are available from the workshop website, promise to serve as a point of reference in the field for some time to come.

References

- Chevaleyre, Y., Endriss, U., Lang, J. & Maudet, N. 2007 A short introduction to computational social choice. *Proceedings of the 33rd Conference on Current Trends in Theory and Practice of Computer Science*, Springer-Verlag.
- Endriss, U. & Lang, J. (eds.) 2006 *Proceedings of the 1st International Workshop on Computational Social Choice*, ILLC, University of Amsterdam. Available at <http://www.illc.uva.nl/~ulle/COMSOC-2006/>.
- Faliszewski, P., Hemaspaandra, E., Hemaspaandra, L. A. & Rothe, J., 2006 A richer understanding of the complexity of election systems, *Technical Report TR-2006-903*, Department of Computer Science, University of Rochester.
- Lang, J. 2004 Logical preference representation and combinatorial vote. *Annals of Mathematics and Artificial Intelligence* **42**(1), 37–71.
- Parikh, R. 2002 Social software. *Synthese* **132**(3), 187–211.