Social Choice on Networks

PhD project proposal

Research group: LILaC, at Université Toulouse 1 Capitole
Supervisors: Umberto Grandi and Laurent Perrussel

Context

The rise of social network analysis as a powerful tool to understand and represent relational structures among individuals has stimulated new lines of research in the study of decision making. Novel frameworks such as networked markets and games on networks are paving the way for a radical change in the way we think and study decisions among interacting agents. Social choice theory, the study of procedures for collective decision making, has been left relatively untouched by these recent developments. The purpose of this project is to provide a novel perspective on problems such as democratic elections, resource allocation and information polls, by **taking into account the network structure linking the individuals participating in a collective choice process**.

Problems of collective choice recently became of prime interest to the community of researchers in **artificial intelligence**: on the one hand, multiagent systems need procedures to coordinate and evaluate their actions, while on the other hand the rise of online tools for decision making is posing theoretical and practical challenges to computer scientists. At the same time, the sudden availability of "big data" is giving researchers access to information about individuals' choices and preferences at an unprecedented scale. Research on the effect of social networks on collective decisions is therefore both timely and relevant for the field of artificial intelligence.

This PhD project aims at producing research results on the **effects of social networks on collective choices**. The object of study are *complex* choices, where the set of possible alternatives has a combinatorial or multi-issue structure. The focus is on *collective* choices, i.e., situations in which a society of agents needs to take a decision, e.g., by means of an election.

Two research directions will be explored:

Computational Models of Influence. An important factor in the study of collective decisions on networks of agents is the study of influence. Existing models from economic theory should be adapted to obtain a computationally oriented framework that can be used for the study of complex collective choices.

Social Choice and Social Networks. A foundational analysis of social choice on networks should be explored, with the potential of defining novel procedures for collective decision making that take into account the information given by the network structure.

Starting point for the investigations of the PhD candidate will be the recently published paper by U. Grandi, E. Lorini and L. Perrussel on *Propositional Opinion Diffusion*, which will allow the student to quickly plunge into a novel and highly debated research topic.

Supervision and Research Environment

The thesis is going to be supervised by Umberto Grandi and Laurent Perrussel from the *LILaC* group at IRIT, located at the University of Toulouse 1 Capitole. The LILaC group has a long-standing expertise in formal models for multiagent systems (logic for multi-agent system, reasoning about change) and in computational social choice (preference aggregation, auctions). This PhD project offers opportunities for strengthening collaborations with the multi-agent system research group *SMAC* at IRIT about agent-based simulations, and the research group in social choice theory at the *Toulouse School of Economics* about voting theory.

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References

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