Stratégie multi-agent pour la négociation d'appariements stables, équitables et optimaux

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1 Introduction

In this paper, we propose a multi-agent framework to distributively solve this kind of assignment problems, by providing agents representing users and negotiating with respect to their preferences. The objective of such procedure is to find an assignment that is *optimal*. For this purpose, we can consider different notions of *social welfare*. For instance, the aim of the utilitarian social welfare is to maximise the sum of individual utilities. Within this paper, we propose *Casanova,* a distributed method to solve the stable marriage problem. We seek to provide agent behaviors leading negotiation processes to socially optimal assignments. We propose a realisation of the minimal concession strategy applied to the stable marriage problem. According to this strategy, agents start the negotiation with their preferred partners. During the negotiation, an agent concedes minimally as soon as its optimal partners has refused. Our strategy has useful properties. Firstly, it preserves the privacy since the agents do not reveal explicitly their preferences. Secondly, the approach improves the optimality of the solution and the equity amongst partners (e.g. men and women).

2 Gale-Shapley Algorithm

Gale and Shapley described in [2] a centralized algorithm that always finds a stable matching for any instance of the stable marriage problem. Gale and Shapley also noted that this algorithm produces a matching in which each man has the best partner he can have in any stable matching.

A distributed version of the GS algorithm (DisEGS) has been proposed by [1]. In this version, contrary to classical GS algorithm, each agent keeps its own preferences, which represents a interesting step towards privacy.

3 Casanova Algorithm

In this study, we consider matchings as emergent phenomena resulting from local agent negotiations. The Casanova algorithm is a negotiation strategy to reach a matching in a SMP. Contrary to the straightforward distributed version of GS, DisEGS, we do not distinguish men and women. Both men and women send concurrently proposals and reply with acceptance or rejections, which represents the main difficulty of this study.

According to Casanova, agents start the negotiation with the best potential partners. During the negotiation, an agent concedes minimally as soon as its optimal partners has refused. A concession is minimal for an agent since there is no other preferred partner which has not yet refused.

4 Evaluation

Casanova has been implemented with Jason. Jason is an interpreter for an extended version of AgentSpeak. It implements the operational semantics of that language, and provides a platform for the development of multi-agent systems. Jason is distributed under GNU LGPL.

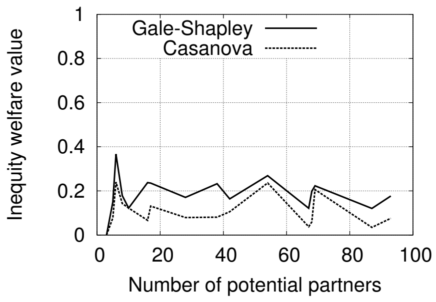

FIG. 1 – The value of the inequity welfare wrt the number of potential partners

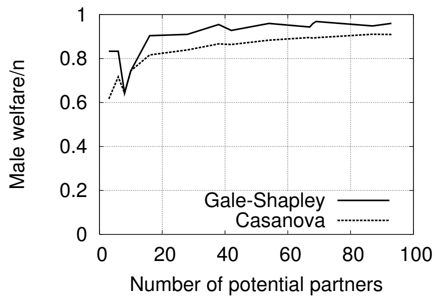

FIG. 2 – The normalized value of the utilitarian welfare wrt the number of potential partners

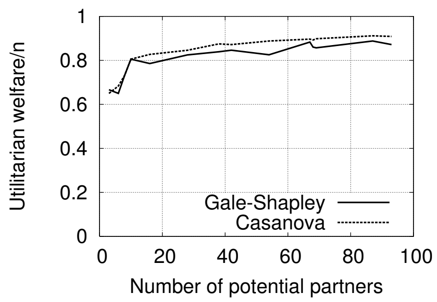

FIG. 3 – The normalized value of the male welfare wrt the number of potential partners

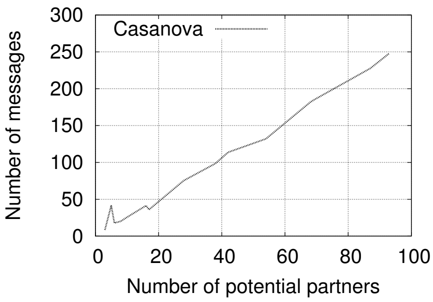

FIG. 4 – The number of messages wrt the number of potential partners

5 Conclusion

Casavona presents interesting properties, because agents do not act differently depending on their community (each agent proposes and disposes). First, as shown in our experimental results, Casanova finds matchings that *improves the optimality of the matching and the equity amongst the partners*. Second, contrary to GS [2], Casanova also *improves the privacy* of preference lists because of the distribution of these lists among agents, as in the SM formulation for DisEGS or DisFC proposed in [1]. Moreover, messages are asynchronously sent and there is no assumption on the order of reception of *propose* messages. Therefore, agents cannot deduce systematically their position within the preference list of their proposers.

Références

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