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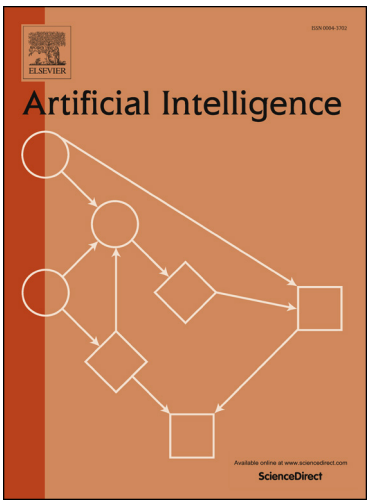

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Filippo Bistaffa, Alessandro Farinelli, Georgios Chalkiadakis, Sarvapali D. Ramchurn

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A Cooperative Game-Theoretic Approach to the Social Ridesharing Problem

Filippo Bistaffa[a,*], Alessandro Farinelli[a], Georgios Chalkiadakis[b], Sarvapali D. Ramchurn[c]

[a] *Department of Computer Science, University of Verona, Italy*
[b] *School of Electrical and Computer Engineering, Technical University of Crete, Greece*
[c] *Electronics and Computer Science, University of Southampton, United Kingdom*

Abstract

In this work, we adopt a cooperative game theoretic approach in order to tackle the *social ridesharing* (SR) problem, where a set of commuters, connected through a social network, form coalitions and arrange one-time rides at short notice. In particular, we address two fundamental aspects of this problem. First, we focus on the optimisation problem of forming the travellers' coalitions that minimise the travel cost of the overall system. To this end, we model the formation problem as a Graph-Constrained Coalition Formation (GCCF) one, where the set of feasible coalitions is restricted by a graph (i.e., the social network). Our approach allows users to specify both *spatial* and *temporal* preferences for the trips. Second, we tackle the *payment allocation* aspect of SR, by proposing the first approach that computes *kernel-stable payments* for systems with thousands of agents. We conduct a systematic empirical evaluation that uses real-world datasets (i.e., GeoLife and Twitter). We are able to compute optimal solutions for medium-sized systems (i.e., with 100 agents), and high quality solutions for very large systems (i.e., up to 2000 agents). Our results show that our approach improves the social welfare (i.e., reduces travel costs) by up to 36.22% with respect to the scenario with no ridesharing. Finally, our payment

*Corresponding author
Email addresses: filippo.bistaffa@univr.it (Filippo Bistaffa), alessandro.farinelli@univr.it (Alessandro Farinelli), gehalk@intelligence.tuc.gr (Georgios Chalkiadakis), sdr@ecs.soton.ac.uk (Sarvapali D. Ramchurn)