Partial Cooperation in Multi-agent Local Search

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Abstract. Multi-agent systems usually address one of two forms of interaction. One has completely competitive agents that act selfishly, each maximizing its own gain from the interaction. Auctions and voting scenarios usually assume such agents and follow game theoretic results. The other form of interaction has multiple agents that cooperatively search for some global goal, such as an optimal time slot allocation for all landing aircrafts in an airport. The present paper proposes a paradigm for multiple agents solving a distributed problem using local search algorithms and acting in a partially cooperative manner. That is, agents with different preferences search for a minimal cost solution to an Asymmetric Distributed Constraints Optimization Problem (ADCOP), while keeping a limited form of self interest.

Two approaches for using local search in the partial cooperative paradigm are proposed. The first, modifies the anytime mechanism introduced by Zivan [19] so that agents can eliminate solutions which do not satisfy their cooperation thresholds. The second proposes a new local search algorithm that explores only valid solutions. The performance of two innovative algorithms implementing these two approaches, are compared with state of the art local search algorithms on three different setups. When personal constraints are strict, the proposed algorithms have a large advantage over existing algorithms. We provide insights to the success of existing algorithms within the anytime framework when constraints are loose.

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