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Chattrakul Sombattheera
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Advances in Practical Optimal Coalition Structure Algorithms

A thesis submitted in fulfillment of the
requirements for the award of the degree

Doctor of Philosophy

from

UNIVERSITY OF WOLLONGONG

by

Chattrakul Sombattheera

School of CS and SE.
June 2010

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Dedicated to

My Parents

Declaration

This is to certify that the work reported in this thesis was done by the author, unless specified otherwise, and that no part of it has been submitted in a thesis to any other university or similar institution.

Chattrakul Sombattheera
June 20, 2010

Abstract

This thesis presents a number of algorithms for forming coalitions among cooperative agents in pragmatic domains where traditional cooperative game theory solution concepts do not apply due to bounded rationality of agents. While previous work in coalition formation in multi-agent systems research operated on relatively small number of agents, e.g. less than 30 agents, this work explores coalition formation among 100 agents, this is due to limited computational resources not the performance of the our algorithms. We explore a best-first search centralized algorithm for optimal coalition structures which is based on a novel idea of deciding what is the best coalition to put into coalition structure being generated. Empirical results show that the solution reaches optimality quickly and terminates quickly in pragmatic domains. We further explore on optimal coalition structures with distributed algorithms in linear and non-linear domains. For the linear domains, we explore linear production and integer programming. For the non-linear domains we explore logistic providers. Based on existing algorithms, we explore a novel environment of forming coalitions in supply networks involving buyers, sellers and logistics providers agents. In this setting, buyers form coalitions to increase their negotiation power while sellers and logistics providers form coalitions to aggregate their supply power and optimize their resources usage.

List of Publications

The material of this thesis is based on the following publications:

1. Chattrakul Sombattheera, Aditya Ghose: A best-first anytime algorithm for computing optimal coalition structures. AAMAS (3) 2008: 1425-1428
2. Chattrakul Sombattheera, Aditya Ghose: A Pruning-Based Algorithm for Computing Optimal Coalition Structures in Linear Production Domains. Canadian Conference on AI 2006: 13-24
3. Chattrakul Sombattheera, Aditya Ghose: A Distributed Algorithm for Coalition Formation in Linear Production Domain. ICEIS (2) 2006: 17-22
4. Chattrakul Sombattheera, Aditya Ghose: Supporting Dynamic Supply Networks with Agent-Based Coalitions. IEA/AIE 2006: 1127-1137
5. Chattrakul Sombattheera, Aditya K. Ghose: A Distributed Branch-and-Bound Algorithm for Computing Optimal Coalition Structures. SETN 2006: 334-344
6. Chattrakul Sombattheera and Aditya Ghose: Agent-based Coalitions in Dynamic Supply Chains. the international conference 9th Pacific Asia Conference on Information Systems (PACIS 2005).
7. Chattrakul Sombattheera, Aditya Ghose, Peter Hyland: A Framework to Support Coalition Formation in Supply Chain Collaboration. ICEB 2004: 1-6

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