University of Zurich[UZH]

Dynamic Distributed Constraint Optimization

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Daniel Hegglin
of Oerlikon ZH, Switzerland

Student-ID: 08-721-102
dani.hegglin@gmail.com

Advisor: **Mihaela Verman**

Prof. Abraham Bernstein, PhD
Institut für Informatik
Universität Zürich
http://www.ifi.uzh.ch/ddis

Acknowledgements

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Zusammenfassung

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Abstract

This thesis is about understanding the performance and behaviour of various existing distributed constraint optimization algorithm approaches (complete, local-iterative message-passing, local-iterative best-response) in context of a dynamic environment, e.g changing constraints or other parameters. The use case for this analysis will be the scheduling problem, which needs to be mapped to the algorithms accordingly. The goals are adding a general module to the existing framework for dcops, which can simulate dynamic environments / parameter changes in various ways, mapping existing dcop algorithms to signal collect and evaluate their performance. An additional goal would be to suggest or test a blended algorithm with local-iterative characteristics that handles change better by applying techniques from dynamic approaches which are not local-iterative. The benchmarking is done with respect to change (resilience to change / stability, amount of variable value changes necessary to bounce back), solution quality (how fast can the algorithms reach a defined quality), Time-to-Convergence (how long does it take to converge).

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1

Introduction

- aufgabenstellung: ausfuehrlich - motivation - ziele, forschungsresultate die ich liefern mÃ$\mathbf{P}_c$hte

Figure environment.

2

Background

2.1 Constraint Optimization

2.2 Distributed Constraint Optimization

2.3 Complete and Incomplete

2.4 Local-Iterative Message Passing

2.5 Local-Iterative Best Response

2.6 Dynamic

2.7 Scheduling Problem

3

Related Work

3.1 Constraint Optimization Approaches

- Constraint Optimization Basics - Distributed Constraint Optimization - Local Iterative Approaches - Best-Response Approaches - Complete Approaches - Incomplete Approaches - Distributed Approaches - Dynamic Approaches - Distributed and Dynamic Approaches

3.2 Use Cases for Constraint Optimization

- Applications of those approaches

3.3 Constraint Optimization Benchmarking

- Benchmarking

4

Design

4.1 Mapping Algorithms to Signal/Collect

4.2 Scheduling Problem Definition and General Mapping

4.3 Change Module as Framework Extension

4.4 DCOP Algorithms

4.4.1 Complete - DCOP

- Distributed, Not Dynamic, Complete -¿ Show what is wrong with this approach regarding dynamic

4.4.2 Dynamic, Complete - RSDPOP

4.4.3 Not local-iterative - SBDO

- Distributed, Dynamic, Not-Local-Iterative -¿ Show what is wrong with this approach regarding dynamic

4.4.4 Best-Respone - Maximum Gain Messaging

- Distributed, Not Dynamic, Not-Local-Iterative -¿ Show what is wrong with this approach regarding dynamic

4.4.5 Best Response - DSA

4.4.6 Local Iterative - MaxSum

-¿ Local Iterative -¿ Good fit for dynamic -¿ Better than the above -¿ Fewer information disclosure

4.4.7 Best Response, Local Search - Population-Based Iterated Local Search

Why Population-Based for Dynamic Problems

-¿ Local Iterative -¿ Provides multiple solutions to a problem -¿ Good fit for dynamic -¿ check which solution is best for changed circumstances -¿ Good fit to stop getting stuck in local optima -¿ Better than the above

Implementation in Signal/Collect

4.5 Testbed

4.5.1 Dataset

4.5.2 Evaluation

5

Implementation

5.1 Change Module for Framework

5.2 Testbed

- Datasets - Storage of Results - Evaluation

5.3 DCOP in Signal/Collect

5.4 SBDO in Signal/Collect

5.5 Best-Response in Signal/Collect

5.6 DSA in Signal/Collect

5.7 Max-Sum in Signal/Collect

5.8 Population-based in Signal/Collect

6

Experiments

6.1 Experiment Design

6.2 Testing Environment

6.3 Results

6.3.1 Resilience to dynamic Environments

- Mainly to proof flaws of the other approaches when it comes to dynamic

6.3.2 Solution Quality

- Static / Dynamic - Mainly to proof the ability of new approaches to keep stable and reach certain goals

6.3.3 Time to Convergence

6.3.4 Scalability

- Number of Messages - Number of Agents - Mainly to show that local-iterative scales well because the number of messages is low

6.3.5 Hardware Requirements

- Additional layer of argumentation and analysis

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Limitations

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Future Work

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Conclusions

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References

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Appendix

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