Parallel Consistency in Constraint Programming

Master internship.

Arnaud Lallouet - Antoine Petitet
Huawei Technologies Ltd
2012 Lab / CSI Paris / DC
20 Quai du Point du Jour, 92100 Boulogne-Billancourt

Context

Huawei is one of the world leading company in information and communication technology. Our products and solutions include processor development, servers, 5G base stations, network services, cloud services and mobile phones, serving more than one third of the world's population in more than 170 countries. Our innovations and partnerships are motivated by customer satisfaction and providing the best user experience. The Declarative Computing team is part of the Paris Research Center in Boulogne-Billancourt and focuses on fundamental and applied research on Constraint programming and related paradigms (CP, SAT, SMT, Logic-based formalisms, etc.), and also on applications like scheduling, routing, configuration, etc.

Project

Constraint Programming (CP) is a generic tool to represent and solve combinatorial problems and has found its way into industrial applications. As a declarative paradigm, it has been the subject of many years of research to improve its efficiency, including parallel approaches [8, 5, 2, 6, 1]. Constraint Programming is composed of search and inference. From the point of view of parallel solving, these two components are very hard to deal with: search is NP-complete and inference is P-complete [3]. In this work, we would like at first to rethink parallel consistency, which is interesting on networks of particular structure like cycle, tree or chain [4] but has been proven difficult to implement [7, 1], showing speed-ups of 3 on CPU to 6 on GPU. However, no particular study has been devoted to predict where and when parallel consistency can be applicable. It is very likely that a phase transition could exist for P-complete problems just like it does for NP-complete problems. Can we prove experimentally its existence? What are the features needed to exploit it? The study will try to bring new theoretical and practical results.

Candidate

We are looking for a highly motivated Engineering School or Master's degree candidate in Computer Science who is motivated by the following fields: artificial intelligence, theory of computing, algorithms, constraint reasoning, high-performance implementation, parallel programming, machine learning, deep learning, reinforcement learning. Strong programming abilities are mandatory (we use C++).
Please contact us at the email addresses below. Include a detailed CV and motivation letter, undergraduate and graduate marks, list of the courses followed, project or internship reports, name of two person who can recommend you and/or recommendation letters, link to personal GitHub if any.

Working environment

Supervision in the Paris Research Center will be done by Prof. Arnaud Lallouet, Antoine Petitet and the Declarative Computing team. The Paris Research Center of Huawei Technologies provides a high level scientific environment hosting many researchers on different topics ranging from communication theory to machine learning and cutting-edge hardware facilities. It enjoys also a nice working environment on the Seine riverside with excellent restaurant (free for interns) and leisure zone with snooker table and videogames.

Contacts

Arnaud Lallouet, Huawei Technologies Ltd, `arnaud.lallouet@huawei.com`
Antoine Petitet, Huawei Technologies Ltd, `antoine.petitet@huawei.com`

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