



Heuristic based on Machine Learning for Constraint Programming

Master internship.

Arnaud Lallouet

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. Constraint Programming is composed of search and inference. In large industrial problem, it is often the case that the user has to program complex search techniques in order to explore the search space. The goal of this project is to investigate how Machine Learning can guide the search strategy of a solver, in the light of recent works on integration of reinforcement learning [3, 4] and graph neural networks [2, 1]. After a study of the literature, one ML strategy will be chosen, then implemented in a constraint solver and thoroughly tested.

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 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

References

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- [4] Hugues Watez, Frédéric Koriche, Christophe Lecoutre, Anastasia Paparrizou, and Sébastien Tabary. Learning variable ordering heuristics with multi-armed bandits and restarts. In Giuseppe De Giacomo, Alejandro Catalá, Bistra Dilkina, Michela Milano, Senén Barro, Alberto Bugarín, and Jérôme Lang, editors, *ECAI 2020 - 24th European Conference on Artificial Intelligence, 29 August-8 September 2020, Santiago de Compostela, Spain, August 29 - September 8, 2020 - Including 10th Conference on Prestigious Applications of Artificial Intelligence (PAIS 2020)*, volume 325 of *Frontiers in Artificial Intelligence and Applications*, pages 371–378. IOS Press, 2020.