Interactive CONstraint-based Configuration: Hybridization of filtering and compilation approaches

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Abstract

Who has never wanted to own a particular product, such as shoes, smart-phone, cosmetic, car, etc., specially designed for him/her, perfectly suited to his/her desires, and affordable ? For several decades now, customers want to bring a personal touch to their products to make them special and unique. To meet this demand of personalization, companies nowadays no longer offer standard products, but more and more personalizable ones. Thanks to the Web technologies, this personalization is done directly and interactively online. Customers can play with the range of choices and options offered by companies: they can assemble, cut, color, choose, ... visualize the result of their desires and ultimately order it, in a few minutes with a few clicks. This concept of personalization or configuration of products consists in assembling modules or predefined components, to produce a unique and specific product. For businesses, this is a way to offer personalized products to stand out from the competition and build customers' loyalty through more accurately reflecting their tastes and needs. The major difficulty of personalization or configuration of products lies in managing the diversity offered to customers: how to be sure that all the combinations of choices, variants and options offered to the customers are achievable in a reasonable time and affordable price ? Constraint satisfaction problems or CSP are very often used to formalize product configuration problems in both research and industry. CSP formalize relevant knowledge through variables, each one associated to a definition domain, linked by constraints, limiting the combinations of their permissible values. Thus, CSP makes it possible to describe exhaustively the solution space, corresponding to a set of all possible products. Two different methods of processing CSP allow to exploit the generic models in an interactive way: problem filtering methods (reasoning directly on the CSP network and removing inconsistent values) and solution filtering methods (reasoning on a representation of the solution space in the form of a compiled graph). Both of the methods have advantages and drawbacks in online product configuration. This paper aims at putting the first ideas on the joint use of these two methods in the same interactive configuration problem.

Keywords
Configuration, CSP, Compilation, Filtering Method

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Idir Boumbar, Ph.D. Student, P.Eng. is currently as a PhD student of Industrial Engineering at ISAE SUPAERO and IMT Mines Albi. He received his Master in Computer Science in 2021 .

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Hélène Fargier is senior researcher for CNRS at IRIT. Her main research work deals with decision making under uncertainty: at the formal level (decision theory, preferences and knowledge representation), at the algorithmic level (constraint satisfaction, knowledge compilation) and at the application level product configuration). Since 2005, she has supervised 10 thesis and has been involved in more than 20 national or international research projects. She was the coordinator of one ANR project (BR4CP: "Business recommendations for configurable products", two research working groups and has represented IRIT in 5 industrial contracts (most of them about configuration; e.g. Renault, Pros). She is the co-author of more than 130 papers including 35 articles in international journals and 45 papers in high level international conferences with a selective committee. She became an "ECCAI Fellow" in 2014 and is associate editor for the journal "Artificial Intelligence".

Paul Gaborit is an assistant professor at IMT Mines Albi since 1999. He teaches computer science, programming, information systems, networks and databases. His research interests include artificial intelligence, planning, optimization, configuration, constraint programming. He has co-supervised a dozen PhD theses. He is co-author of more than 40 publications and papers. He has participated in the organization of numerous scientific conferences.

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