Synthesizing Filtering Algorithms in Stochastic Constraint Programming

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An interesting topic that recently surged at the borderline of Operations Research (OR) and Constraint Programming (CP) is the connection and the integration of Stochastic Programming (SP) and CP. A trend of research that proposes to apply CP to multi-stage decision problems under uncertainty was firstly outlined in [1]. A novel framework able to capture the notion of Stochastic Constraint Satisfaction Problem (SCSP) was proposed by Walsh in [5]. A scenario-based approach for modeling and solving realistic SCSPs has been subsequently proposed by Tarim et al. in [4].

Stochastic Constraint Satisfaction Problems (SCSPs) are a powerful modeling framework for problems under uncertainty. To solve them is a P-Space task. Tarim's solution approach compiles down SCSPs into classical CSPs. This allows the reuse of classical constraint solvers to solve SCSPs, but at the cost of increased space requirements and weak constraint propagation. This work tries to overcome some of these drawbacks by automatically synthesizing filtering algorithms for global chance-constraints.

Global chance-constraints [3] are the natural extension of global constraints for modeling chance-constraints [2] among a non-predefined number of decision and random variables in stochastic constraint programs.

The filtering algorithms we propose are parameterized by propagators for the deterministic version of the chance-constraints. Our approach allows the reuse of existing propagators in current constraint solvers and it enhances constraint propagation. Our computational experience show the benefits of this novel approach.

References

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