Optimal decision-making under constraints and uncertainty

Latour, A.L.D.

Citation

Latour, A. L. D. (2022, September 13). *Optimal decision-making under constraints and uncertainty. SIKS Dissertation Series*. Retrieved from https://hdl.handle.net/1887/3455662

Propositions

1. SC-ProbLog enables researchers to model constraint satisfaction and optimisation problems that involve stochastic constraints on probability distributions, and is particularly suited for constraints on distributions that arise in probabilistic networks. (Chapter 4)

2. Existing *constraint programming (CP)* and *mixed integer programming (MIP)* technology can be used for solving *stochastic constraint (optimisation) problems (SCPs)* by formulating constraints on *decision diagram (DD)* representations of probability distributions. (Chapter 5)

3. Solving special cases of SCPs (*stochastic constraint (optimisation) problems on monotonic distributions (SCPMDs)* in particular) with CP technology can be sped up by using a dedicated constraint propagation algorithm for the stochastic constraint(s) that exploits the structure of the DD representation of the relevant probability distribution, and guarantees the *generalised arc consistency (GAC)* of the stochastic constraint. (Chapter 6)

4. Applying the paradigm of *programming by optimisation (PbO)* to the development of solvers for SCPs results in fair performance comparisons between methods, and helps researchers to better employ the resulting technology to solve real-world problems. Additionally, it helps researchers to make recommendations for parameter settings of these methods, such that they are likely to perform well on problems from similar but yet unseen domains, if their parameters are set according to those recommendations. (Chapter 7)

5. There are still many open questions about how to integrate probabilistic reasoning techniques, such as knowledge compilation, into CP solvers. One such question is: how can we create an efficient GAC-preserving propagation algorithm for a *stochastic constraint on monotonic distributions (SCMD)*, which operates on *sentential decision diagrams (SDDs)* instead of on *ordered binary decision diagrams (OBDDs)*?

6. In CP solving, it is sometimes best to use domain-specific search heuristics sometimes best to use propagator-specific search heuristics and sometimes best to use domain- and propagator-agnostic search heuristics. We must therefore include heuristics of all these types into CP solving methods.

7. PbO should be applied to all development of new solving techniques in the fields of CP and probabilistic reasoning. Not only because of the reasons mentioned in Propositions 4 and 6, but also because it stimulates creativity.

8. Since the users, beneficiaries and, potentially, victims of *artificial intelligence (AI)* technology are humans, being a good AI researcher requires a dedication to democratising any technology that we develop.

9. It is much easier to be *called* a hardcore feminist than it is to *be* a consistently active, dedicated, intersectional, trans-inclusive, anti-racist, anti-ableist feminist.