Anytime Probabilistic Reasoning

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Reasoning over probabilistic graphical models typically involves answering inference queries, such as computing the most likely configuration (maximum a posteriori or MAP) or evaluating the marginals or the normalizing constant of a distribution (the partition function). A task called marginal MAP generalizes these two by maximizing over a subset of variables while marginalizing over the rest and is also highly instrumental for sequential decision making under uncertainty.

All such queries are known to be intractable in general, leading to the development of many approximate schemes, the major categories of which are variational methods, search algorithms, and Monte Carlo sampling. The key is to leverage ideas and techniques from the three inference paradigms, and integrating them to provide hybrid solutions that inherit their respective strengths.

In this talk I will review the main algorithmic principles for probabilistic reasoning. The emerging solvers allow for flexible trading-off memory for time and time for accuracy and aim for anytime behavior that generates not only an approximation that improves with time, but also confidence bounds which become tighter with more time. Our hybrid schemes produced solvers that won competitions, some are integrated into probabilistic languages (Figaro and Markov Logic) and also into software applications such as Superlink-Online for Linkage analysis.

Bio

Rina Dechter's research centers on computational aspects of automated reasoning and knowledge representation including search, constraint processing, and probabilistic reasoning. She is a Chancellor's Professor of Computer Science at University of California, Irvine. She holds a Ph.D. from UCLA, an M.S. degree in applied mathematics from the Weizmann Institute, and a B.S. in mathematics and statistics from the Hebrew University in Jerusalem. She is the author of *Constraint Processing* published by Morgan Kaufmann (2003), and of *Reasoning with Probabilistic and Deterministic Graphical Models: Exact Algorithms* published by Morgan and Claypool Publishers (2013, second ed. 2019). She has co-authored close to 200 research papers and has served on the editorial boards of: Artificial Intelligence, the Constraint Journal, Journal of Artificial Intelligence Research (JAIR), and Journal of Machine Learning Research (JMLR). She is a Fellow of the American Association of Artificial Intelligence since 1994, was a Radcliffe Fellow during 2005–2006, received the 2007 Association of Constraint Programming (ACP) Research Excellence Award, and became an ACM Fellow in 2013. She served as a Co-Editor-in-Chief of Artificial Intelligence from 2011 to 2018 and is the conference chair-elect of IJCAI-2022.
