**Binder, John**; **Koller, Daphne**; **Russell, Stuart**; **Kanazawa, Keiji**
**Adaptive probabilistic networks with hidden variables.** (English) Zbl 0892.68079
Mach. Learn. 29, No. 2-3, 213-244 (1997).

Summary: Probabilistic networks (also known as Bayesian belief networks) allow a compact description of complex stochastic relationships among several random variables. They are used widely for uncertain reasoning in artificial intelligence. In this paper, we investigate the problem of learning probabilistic networks with known structure and hidden variables. This is an important problem, because structure is much easier to elicit from experts than numbers, and the world is rarely fully observable. We present a gradient-based algorithm and show that the gradient can be computed locally, using information that is available as a byproduct of standard inference algorithms for probabilistic networks. Our experimental results demonstrate that using prior knowledge about the structure, even with hidden variables, can significantly improve the learning rate of probabilistic networks. We extend the method to networks in which the conditional probability tables are described using a small number of parameters. Examples include noisy-OR nodes and dynamic probabilistic networks. We show how this additional structure can be exploited by our algorithm to speed up the learning even further. We also outline an extension to hybrid networks, in which some of the nodes take on values in a continuous domain.

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