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Dealing with external actions in belief causal networks. (English) Zbl 1316.68158

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Summary: Graphical models are efficient and simple ways to represent dependencies between variables. We introduce in this paper the so-called belief causal networks where dependencies are uncertain causal links and where the uncertainty is represented by belief masses. Through these networks, we propose to represent the results of passively observing the spontaneous behavior of the system and also evaluate the effects of external actions. Interventions are very useful for representing causal relations, we propose to compute their effects using a generalization of the "do" operator. Even if the belief chain rule is different from the Bayesian chain rule, we show that the joint distributions of the altered structures to graphically describe interventions are equivalent. This paper also addresses new issues that are arisen when handling interventions: we argue that in real world applications, external manipulations may be imprecise and show that they have a natural encoding under the belief function framework.

MSC:

68T30 Knowledge representation
68T37 Reasoning under uncertainty in the context of artificial intelligence

Keywords:

belief function theory; causal networks; "do" operator; interventions

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