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Variable elimination for interval-valued influence diagrams. (English) [Zbl 06507047](#)

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Summary: Influence diagrams are probabilistic graphical models used to represent and solve decision problems under uncertainty. Sharp numerical values are required to quantify probabilities and utilities. Yet, real models are based on data streams provided by partially reliable sensors or experts. We propose an interval-valued quantification of these parameters to gain realism in the modelling and to analyse the sensitivity of the inferences with respect to perturbations of the sharp values. An extension of the classical influence diagrams formalism to support interval-valued potentials is provided. Moreover, a variable elimination algorithm especially designed for these models is developed and evaluated in terms of complexity and empirical performances.

For the entire collection see [\[Zbl 1316.68008\]](#).

MSC:

68T37 Reasoning under uncertainty in the context of artificial intelligence

Keywords:

[influence diagrams](#); [Bayesian networks](#); [credal networks](#); [sequential decision making](#); [imprecise probability](#)

Full Text: [DOI](#)

References:

- [1] Hugin Expert network repository. <http://www.hugin.com/technology/samples>
- [2] Benferhat, S., Smaoui, S.: Hybrid possibilistic networks. *Int. J. Approximate Reasoning* 44(3), 224–243 (2007) · [Zbl 1116.68094](#) · [doi:10.1016/j.ijar.2006.07.012](#)
- [3] Bielza, C., Gómez, M., Insua, S.R., del Pozo, J.A.F., Barreno, P.G., Caballero, S., Luna, M.S.: IctNEO system for jaundice management. *Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales* 92(4), 307–315 (1998)
- [4] Cozman, F.G.: Credal networks. *Artif. Intell.* 120, 199–233 (2000) · [Zbl 0945.68163](#) · [doi:10.1016/S0004-3702\(00\)00029-1](#)
- [5] de Campos, L.M., Huete, J.F., Moral, S.: Probability intervals: a tool for uncertain reasoning. *Int. J. Uncertainty Fuzziness Knowl. Based Syst.* 2(02), 167–196 (1994) · [Zbl 1232.68153](#) · [doi:10.1142/S0218488594000146](#)
- [6] Fagioli, E., Zaffalon, M.: Decisions under uncertainty with credal influence diagrams. Technical report, pp. 51–98, IDSIA (1998). (unpublished)
- [7] Fertig, K.W., Breese, J.S.: Probability intervals over influence diagrams. *IEEE Trans. Pattern Anal. Mach. Intell.* 15(3), 280–286 (1993) · [Zbl 05110958](#) · [doi:10.1109/34.204910](#)
- [8] Howard, R.A., Matheson, J.E.: Influence diagram retrospective. *Decision Anal.* 2(3), 144–147 (2005) · [doi:10.1287/deca.1050.0050](#)
- [9] Huntley, N., Troffaes, M.C.M.: Normal form backward induction for decision trees with coherent lower previsions. *Ann. Oper. Res.* 195(1), 111–134 (2012) · [Zbl 1259.91039](#) · [doi:10.1007/s10479-011-0968-2](#)
- [10] Jensen, F.V., Nielsen, T.D.: *Bayesian Networks and Decision Graphs*. Springer Verlag, New York (2007) · [Zbl 1277.62007](#) · [doi:10.1007/978-0-387-68282-2](#)
- [11] Kikuti, D., Cozman, F.G., de Campos, C.P.: Partially ordered preferences in decision trees: computing strategies with imprecision in probabilities. In: *IJCAI Workshop on Advances in Preference Handling*, pp. 118–123 (2005)
- [12] Kjaerulff, U.: *Triangulation of graphs - algorithms giving small total state space*. Research report R-90-09, Department of Mathematics and Computer Science, Aalborg University, Denmark (1990)
- [13] Lucas, P.J.F., Taal, B.: Computer-based decision support in the management of primary gastric non-hodgkin lymphoma. In: *UU-CS*, vol. 33 (1998)
- [14] Nielsen, T.D., Jensen, F.V.: Sensitivity analysis in influence diagrams. *IEEE Trans. Syst. Man Cybern. Part A Syst. Hum.* 33(2), 223–234 (2003) · [doi:10.1109/TSMCA.2003.811116](#)
- [15] Raiffa, H.: *Decision Analysis: Introductory Lectures on Choices Under Uncertainty*. Addison-Wesley, Boston (1968) · [Zbl](#)

0181.21802

- [16] Shenoy, P.P.: Valuation-based systems for Bayesian decision analysis. *Oper. Res.* 40(3), 463–484 (1992) · [Zbl 0850.62131](#) · [doi:10.1287/opre.40.3.463](#)
- [17] Xu, H., Smets, P.: Reasoning in evidential networks with conditional belief functions. *Int. J. Approximate Reasoning* 14(2–3), 155–185 (1996) · [Zbl 0941.68764](#) · [doi:10.1016/0888-613X\(96\)00113-2](#)
- [18] Zhang, N.L., Poole, D.: Exploiting causal independence in Bayesian network inference. *J. Artif. Intell. Res.* 5, 301–328 (1996) · [Zbl 0900.68384](#)

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