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Paul D. Thorn, Gerhard Schurz

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Qualitative Probabilistic Inference Under Varied Entropy Levels

Paul D. Thorn[1], and Gerhard Schurz[1]

[1] Heinrich-Heine-University, Institute for Philosophy, Universitaetsstr. 1, 40204 Duesseldorf, Germany
{thorn, schurz}@phil-fak.uni-duesseldorf.de

Abstract. In previous work, we studied four well known systems of qualitative probabilistic inference, and presented data from computer simulations in an attempt to illustrate the performance of the systems. These simulations evaluated the four systems in terms of their tendency to license inference to accurate and informative conclusions, given incomplete information about a randomly selected probability distribution. In our earlier work, the procedure used in generating the unknown probability distribution (representing the true stochastic state of the world) tended to yield probability distributions with moderately high entropy levels. In the present article, we present data charting the performance of the four systems when reasoning in environments of various entropy levels. The results illustrate variations in the performance of the respective reasoning systems that derive from the entropy of the environment, and allow for a more inclusive assessment of the reliability and robustness of the four systems.

Keywords: ampliative inference, default reasoning, non-monotonic reasoning, probability logic.

1 Balancing Reward and Risk in LP-Reasoning in Environments of Different Entropy

Systems of *logico-probabilistic* (LP) reasoning characterize inferences from conditionals that are interpreted as expressing high conditional probabilities. We formalize these conditionals using object-language statements of the form, A⇒B, which assert that P(B|A) is 'high'. The probabilistic interpretation of uncertain conditionals was suggested in philosophy by Adams [1], and within the AI community by Pearl ([2], ch. 10; [3]), Lehmann and Magidor [4], and Goldszmidt and Pearl [5]. In the latter three papers, the focus lay on the interpretation of uncertain conditionals as corresponding to conditional probabilities taking values that are arbitrarily close to 1. In contrast, our work assumes a non-infinitesimal interpretation according to which the relevant conditional probabilities should be high (e.g., ≥ 0.9) but not necessarily 'extremely high'. Non-infinitesimal probability semantics is based on the "improbability-