Abstract for Presentation

Abstract

Title:	Constructing arguments from Bayesian networks about forensic evidence
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Abstract: (300-400 words)	Due to the growing popularity of scientific evidence, such as DNA and fingerprint matching, the communication and interpretation of legal evidence has become a real challenge [1, 2, 3]. This is illustrated by some of the recent miscarriages of justice (like the notorious cases of Sally Clark and Lucia de Berk). The automated extraction of rules, arguments and counter-arguments from Bayesian networks will facilitate the communication between lawyers and judges on the one hand and forensic experts on the other. We propose a method that unifies models of legal proof from two different approaches to legal reasoning: Argumentation [4, 5] and Bayesian networks (BNs) [6]. Argumentation models are closer to the natural way of human reasoning, while BNs can represent uncertain information better than the qualitative argumentative models can. One of the goals of our research is to automatically generate arguments from a given BN. We follow the ASPIC+ [5] definition of an argument where every argument is either a simple variable instantiation or the application of a rule. The ASPIC+ framework resolves conflicts between arguments by means of an ordering on those rules. Our method of identifying rules is based on a notion of strength which implies that this ordering follows naturally from the strength of the rules. We use a strength measure that equals the probability of the conclusion given the premise divided by the prior probability of the conclusion. This particular measure of strength, also known as the normalized likelihood [7], corresponds with the intuition of positive influence. A rule, contrary to a BN arc, represents a reasoning step and therefore rules in both directions (along and against the direction of the arc in the BN) can exists simultaneously. We calculate the strength of every candidate rule and discard the rules that have a strength less than or equal to one. With the remaining rules and their ordering the ASPIC+ argumentation framework defines the applicable arguments and their attack relation. We explicitly disallow the application of rules against the direction of the corresponding arc in

	the BN after rules along the direction of an arc. This has the effect that a reasoning error that was identified by Pearl [8] can no longer be made. The described method can be used to explain the probabilistic results of the Network in terms of arguments.
References:	[1] Norman E. Fenton, Martin Neil, and David A. Lagnado. A general structure for legal arguments about evidence using Bayesian Networks. Cognitive Science, 37(1):61–102, 2013. [2] Jeroen Keppens. Argument diagram extraction from evidential Bayesian Networks. Artificial Intelligence and Law, 20(2):109–143, 2012. [3] Carmen Lacave, Manuel Luque, and Francisco Javier Dıez . Explanation of Bayesian Networks and influence diagrams in elvira. Systems, Man, and Cybernetics, Part B, 37(4):952–965, 2007. [4] Phan Minh Dung. On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games. Artificial Intelligence, 77:321–357, 2005. [5] Sanjay Modgil and Henry Prakken. A general account of argumentation with preferences. Artificial Intelligence, 195:361–397, 2013. [6] Judea Pearl. Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference. Morgan Kaufmann, 1988. [7] Vincenzo Crupi, Katya Tentori, and Michel Gonzales. On Bayesian measures of evidential support: Theoretical and empirical issues. Philosophy of Science, 74(2):229–252, april 2007. [8] Judea Pearl. Embracing causality in default reasoning. Artificial Intelligence, 35:259–271, 1988.