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Special Issue on the 1996 Uncertainty in AI (UAI'96) Conference—Preface

Piero P. Bonissone
General Electric Corporate Research and Development
Schenectady, New York

Every year, the Uncertainty in Artificial Intelligence (UAI) Conference provides a highly selected forum in which the most important innovations in the field of reasoning with uncertain, imprecise, and imperfect information are presented and discussed.

As program and conference chair of past UAI conferences, I am particularly proud of the content presented during this year's conference. As the editor-in-chief of *IJAR*, I encouraged some of the authors of papers presented at UAI'96 to extend their original material, incorporating the feedback received during the conference, and presenting a more complete analysis of their results.

In this special issue of the *International Journal of Approximate Reasoning*, we want to present some these results to a broader scientific community. This special issue contains a representative sample of a wide gamut of approaches to reasoning with uncertain and imprecise information.

The first paper, "A Characterization of Markov Equivalence for Directed Cyclic Graphs," by Richardson, proposes a set of necessary and sufficient conditions, verifiable in polynomial time, for deciding if two directed cyclic graphs (DCGs) are Markov equivalent. From the results of this paper, it will be possible to build efficient polynomial-time algorithms to test for Markov equivalence in DCGs.

The second paper, "Estimating Extreme Probabilities Using Tail Simulated Data," by Castillo, Solares, and Gomez, presents two methods for estimating the extreme probabilities of target variables, which are monotone functions of a set of basic variables, whose cumulative distribution

Address correspondence to Dr. P. Bonissone, GE CRD, K1, Room 5C32A, 1 Research Circle, Schenectady, NY 12305. E-mail: BONISSONE@CRD.GE.COM.

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functions (cdfs) are not directly available. Both methods are very useful for sensitivity analysis in Bayesian networks or uncertainty in risk analysis, when very large confidence intervals for the marginal/conditional probabilities are required.

In the third paper, "Hybrid Algorithms for Approximate Belief Updating in Bayes Nets," Santos, Shimony, and Williams address the issue of computing marginal probabilities in a multiply connected Bayes networks. Since the generation of exact solutions is NP-hard, the authors approximate the solutions by using randomized algorithms that accumulate high-probability partial instantiations, resulting in probability bounds.

Bauer, in his paper "Approximation Algorithms and Decision Making in the Dempster-Shafer Theory of Evidence—an Empirical Study," covers the issue of computational complexity of reasoning based on Dempster-Shafer theory. The paper reviews a number of DS approximation algorithms based on the reduction of the number of focal elements in the belief functions involved, and proposes a new one, designed to cause minimal deviations in those values that are relevant to decision making.

The issue of computational efficiency is addressed by Shenoi in his paper "Binary Join Tree for Computing Marginals in the Shenoy-Shafer Architecture," in which he proposes an efficient data structure to perform local computations in a valuation network.

Studeny's paper, entitled, "On a Recovery Algorithm for Chain Graphs," addresses another important issue. Given the conditional independence structure of a chain graph (CG), the paper describes an algorithm to find the largest CG of the corresponding class of Markov equivalent GCs. Chain graphs, covering both undirected graphs (UG) and direct acyclic graphs (DAGs), were proposed in the middle eighties to represent the structure of probabilistic conditional independence. While different UGs have different CGs, different DAGs may be Markov equivalent and have the same conditional structure. However, the largest CG of the corresponding class of Markov equivalent CGs can be used to represent the same dependency model.

We conclude this special issue with the article by Dubois and Prade entitled "A Synthetic View of Belief Revision with Uncertain Inputs in the Framework of Possibility Theory." In this paper the authors present a possibilistic setting for belief revision in which they capture William's transmutations (previously defined in the setting of Spohn's functions) as well as Boutillier's natural revision.