Probabilistic logic has been discussed in a recent paper by Nilsson. An entailment scheme is proposed that can predict the probability of an event when the probabilities of certain other connected events are known. This scheme involves the use of a maximum entropy method proposed by Cheeseman. The model uses vectors that represent certain possible states of the world. Only consistent vectors are entered into the probability scheme. As a result, entailment does not always yield an acceptable result and cannot be applied to real situations that could arise.

This paper investigates a technique to overcome this problem, which involves extending the idea of probabilistic logic and the maximum entropy approach to Dempster-Shafer theory. A new entailment scheme for belief functions is used that produces well-defined results even when only "consistent" worlds are being considered.

The paper also reconsiders an earlier attempt by the author to model default reasoning (and subsequent nonmonotonicity) by adding inconsistent vectors to Nilsson's model. In the extended setting, more sensible entailment values are obtained than in the previous work.

A Knowledge Engineer's Comparison of Three Evidence Aggregation Methods

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The comparisons of uncertainty calculi from the last two uncertainty workshops have all used theoretical probabilistic accuracy as the sole metric. While mathematical correctness is important, there are other factors that should be considered when developing reasoning systems. These other factors include the error in uncertainty measures obtainable for the problem and the effect of this error on the performance of the resulting system.

Towards Solving the Multiple Extension Problem: Combining Defaults and Probabilities

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The multiple extension problem frequently arises in both diagnostic and default reasoning. That is, in many settings it is possible to use any of a number of sets of instances, defaults, or hypotheses to explain (expected) observations. In some cases, we choose among explanations by making inferences about information believed to be

implicit in the problem statement. If this is not possible, we may still prefer one explanation to another because it is more likely or optimizes some other measurable property: cost, severity, fairness.

In this paper probabilities and defaults are combined in a simple unified framework that retains the logical semantics of defaults and diagnosis as construction of explanations from a fixed set of possible hypotheses. Probability is viewed as a property of an explanation that can be computed from what is known and what is hypothesized by a valuation function. A procedure is presented that performs an iterative deepening branch-and-bound search for explanations with the property that the first path found is the most likely. The procedure does not consider unlikely paths until more likely ones have been eliminated.

A way is outlined in which probabilities are not constrained by a priori independence assumptions; rather, these statistical assumptions are set up as defaults.

While probability is used as a way of preferring one answer to another, the results apply to any property of an explanation having a valuation function meeting some usefulness criteria.

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Do We Need Higher-Order Probabilities, and, If So, What Do They Mean?

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The apparent failure of individual probabilistic expressions to distinguish uncertainty about truths from uncertainty about probabilistic assessments has prompted researchers to seek formalisms where the two types of uncertainties are given notational distinction. This paper demonstrates that the desired distinction is already a built-in feature of classical probabilistic models, and thus specialized notations are unnecessary.

The Recovery of Causal Poly-Trees from Statistical Data

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Poly-trees are singly connected causal networks in which variables may arise from multiple causes. This paper develops a method of recovering poly-trees from empirically measured probability distributions of pairs of variables. The method guarantees that if the measured distributions are generated by a causal process structured as a poly-tree, then the topological structure of such a tree can be recovered precisely and, in addition, the causal directionality of the branches can be determined up to the maximum extent possible. The method also pinpoints the minimum (if any) external semantics required to determine the causal relationships among the variables considered.

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