Logical Reasoning Under Uncertainty with the Theory of Hints and Probabilistic Argumentation Systems

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The Theory of Hints and Probabilistic Argumentation Systems represent a new framework for reasoning under uncertainty. This framework is based on the Dempster-Shafer theory of evidence. It will be shown that the mathematical concept of hint can nicely represent both the uncertainty and the imprecision that is often attached to the available information. The support function that is derived from a hint measures the weight of the arguments speaking in favour of a hypothesis, whereas the plausibility function indicates the degree of compatibility between the hypothesis and the information. Support and plausibility functions are more general than probability measures in the sense that they can be non-additive. It is interesting to note that Jakob Bernoulli already introduced the idea of support functions in his book called Ars Conjectandi, which was published in 1713. Using the concept of hints and the inference principle provided by Dempster's rule's of combination, classical logical reasoning and probability theory work together to produce a sound method for evaluating the credibility of some hypotheses of interest. The corresponding reasoning systems are called Probabilistic Argumentation Systems (PAS). Their main features will be presented and a computer implementation of PAS called ABEL will be used to discuss an illustrative example.

Biography

Paul-André Monney is currently working as an Independent Consultant in Reasoning under Uncertainty. He has been an Associate Professor of Statistics at the University of Fribourg, Switzerland, and Purdue University. He received a Doctoral Degree in Mathematics and the Venia Legendi in Statistics from the University of Fribourg. He has done extensive research in Theoretical Computer Science and Statistics, in particular the Dempster-Shafer Theory of Evidence. Dr. Monney has numerous publications in scientific journals such as Artificial Intelligence, International Journal of Approximate Reasoning, Journal of Computational and Applied Mathematics and Zeitschrift für Operations Research. He is co-author of A Mathematical Theory of Hints - An Approach to the Dempster-Shafer Theory of Evidence, a book presenting a new perspective on the Dempster-Shafer Theory. In 2003, he published a book entitled A Mathematical Theory of Arguments for Statistical Evidence, in which the theory of hints is applied to the field of statistics.

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