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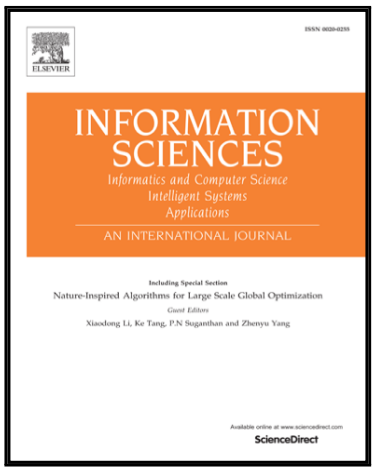

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A Valuation-Based System approach for risk assessment of belief rule-based expert systems

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Abstract

Belief rules extend traditional IF-THEN rules to represent vagueness, incompleteness, and nonlinear causal relationships by assigning belief degrees to singletons or the universe of all possible values that the consequents of rules can take. First, this paper extends belief rules by assigning belief degrees to the subsets of all possible values that the consequents of rules with interval-valued rule weights can take. Then, this paper proposes a Valuation-Based System (VBS) approach for the modeling and risk assessment of extended belief rule-based expert systems. Finally, the proposed VBS approach is applied to two use cases for evaluating the occurrence probabilities of accidents: one is a car equipped with Automated Speed Control (ASC) using values from experts, and the other is hazardous material (hazmat) transportation accidents using real statistical data.

Keywords: Belief rule, Rule-based expert system, Valuation-Based System, Risk assessment, Uncertainty.

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