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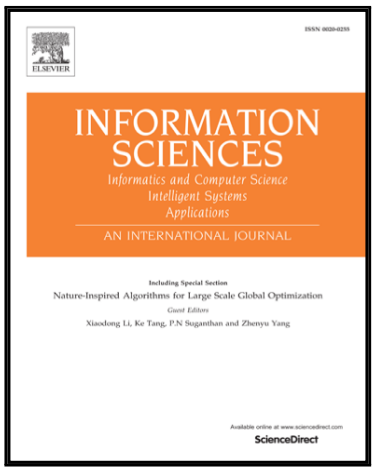

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ACCEPTED MANUSCRIPT

A quantitative approach to reasoning about incomplete knowledge*

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ABSTRACT In this paper, we aim to present a quantitative approach to reasoning about incomplete information. The study is conducted in MEL, a minimal epistemic logic relating modal languages to uncertainty theories. The proposed approach leads to two types of epistemic truth degrees of a proposition. Some related properties are derived. By means of a more general probability distribution on the set of epistemic states, two randomized versions of epistemic truth degrees are obtained. The connection between the notion of local probabilistic epistemic truth degree and belief function is also established. Based upon the fundamental notion of the global epistemic truth degree, the notion of epistemic similarity degree is also proposed and a kind of pseudo-metric used for approximate reasoning in MEL is thus derived. The obtained results provide a useful supplement to the existing study in the sense that it offers a quantitative approach instead of the qualitative manner in the literature.

Keywords : Incomplete information, Quantitative approach, Epistemic truth degree, Quantitative logic

1 Introduction

Various types of formal logical tools have been developed for the representation and reasoning of knowledge, including classical logics (propositional logic and predicate logic), nonclassical logics(multiple-valued logic, fuzzy logic, modal logic, description logic, etc.)([1]-[2],[6],[10]-[13]). They have been widely used as a formalism for knowledge representation in artificial intelligence

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