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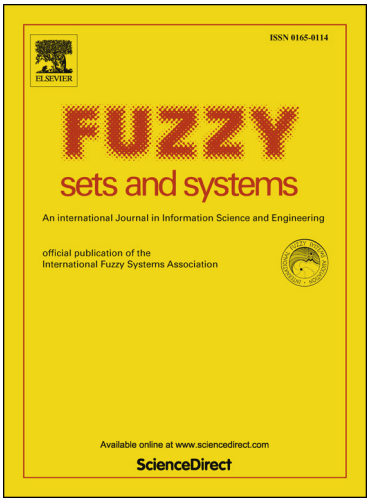

New axiomatisations of discrete quantitative and qualitative possibilistic integrals

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New axiomatisations of discrete quantitative and qualitative possibilistic integrals ☆

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Abstract

Necessity (resp. possibility) measures are very simple min-decomposable (resp. max-decomposable) representations of epistemic uncertainty due to incomplete knowledge. They can be used in both quantitative and qualitative settings. In the present work, we revisit Choquet and Sugeno integrals as criteria for decision under uncertainty and propose new axioms when uncertainty is representable in possibility theory. First, a characterization of Choquet integral with respect to a possibility or a necessity measure is proposed. We respectively add an optimism or a pessimism axiom to the axioms of the Choquet integral with respect to a general capacity. This new axiom enforces the maxitivity or the minitivity of the capacity without requiring the same property for the functional. It essentially assumes that the decision-maker preferences only reflect the plausibility ordering between states of nature. The obtained pessimistic (resp. optimistic) criterion is an average maximin (resp. maximax) criterion of Wald across cuts of a possibility distribution on the state space. The additional axiom can be also used in the axiomatic approach to Sugeno integral and generalized forms thereof to justify possibility and necessity measures. The axiomatization of these criteria for decision under uncertainty in the setting of preference relations among acts is also discussed. We show that the new axiom justifying possibilistic Choquet integrals can be expressed in this setting. In the case of Sugeno integral, we correct a characterization proof for an existing set of axioms on acts, and study an alternative set of axioms based on the idea of non-compensation.

Keywords: Choquet integral, Sugeno integral, possibility theory

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