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Determination of entropy measures for the ordinal scale-based linguistic models

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Abstract. The main objective of this contribution is to develop information about how entropy measures of linguistic terms can be designed. Two different ideas have been put forward to explain this designation: (1) The idea that comes from the seminal definition of fuzziness measure; (2) The idea of transforming similarity measures to entropy ones. To demonstrate the utility and effectiveness of the proposed entropy measures, an entropy-based approach of determining objective weights of attributes is developed to solve multiple-attribute decision-making problems in the context of linguistic term sets.

Keywords: Additive and multiplicative linguistic terms; Entropy measure; Similarity measure.

1 Introduction

Entropy, similarity, and distance measures are the most important research topics in the fuzzy set theory, which have drawn the attention of many researchers who studied these concepts in practical applications, such as decision-making [6, 16, 17, 18, 19], pattern recognition [30, 46], and also in granular computing [1, 2, 7, 13][28][31, 34, 35, 36][41, 43, 45, 49][51, 56, 57][62, 67, 69]. The notion of entropy for fuzzy sets and their extensions allows us to measure the degree of fuzziness, ambiguity, or the uncertainty of a set which returns the amount of difficulty in making a decision whether an element belongs to that set or not. Entropy measure has received more and more attention since its appearance. De Luca and Termini [72] proposed several entropy formulas based on Shannons function and furthermore they put forward an axiomatic definition of entropy measure of fuzzy sets. On the basis of distance between degrees of membership function of a fuzzy set and that of its nearest crisp set, Kaufmann [27] suggested an entropy measure formula for fuzzy sets.

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