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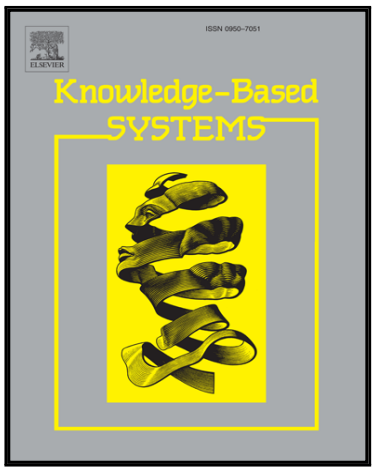

Average-case consistency measurement and analysis of interval-valued reciprocal preference relations

Yucheng Dong, Cong-Cong Li, Francisco Chiclana, Enrique Herrera-Viedma

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Average-case consistency measurement and analysis of interval-valued reciprocal preference relations

Yucheng Dong[a], Cong-Cong Li[a], Francisco Chiclana[b], Enrique Herrera-Viedma[c,d]

[a] *Business School, Sichuan University, Chengdu, China*
[b] *Centre for Computational Intelligence, Faculty of Technology, De Montfort University, Leicester, UK*
[c] *Department of Computer Science and Artificial Intelligence, University of Granada, Granada, Spain*
[d] *Department of Electrical and Computer Engineering, Faculty of Engineering, King Abdulaziz University, Jeddah, Saudi Arabia*

Abstract

Measuring consistency of preferences is very important in decision-making. This paper addresses this key issue for interval-valued reciprocal preference relations. Existing studies implement one of two different measures: the "classical" consistency measure, and the "boundary" consistency measure. The classical consistency degree of an interval-valued reciprocal preference relation is determined by its associated reciprocal preference relation with highest consistency degree, while the boundary consistency degree is determined by its two associated boundary reciprocal preference relations. However, the consistency index of an interval-valued reciprocal preference relation should be determined by taking into account all its associated reciprocal preference relations. Motivated by this, a new consistency measure for interval-valued reciprocal preference relations, the average-case consistency measure, is suggested and introduced. The new average-case consistency measure of an interval-valued reciprocal preference relation is determined as the average consistency degree of all reciprocal preference relations associated to the interval-valued reciprocal preference relation. Furthermore, the analysis and comparison of the different consistency measure internal mechanisms is used to justify the validity of the average-case consistency measure. Finally, an average-case consistency improving method which aims to obtain a modified interval-valued reciprocal preference relation with a required average consistency degree is developed.

Keywords: Decision analysis, reciprocal preference relation, interval-valued preferences, consistency measurement, average-case consistency.

1. Introduction

Reciprocal preference relations are based on the pairwise comparison method, and are widely used preference representation structures in decision-making problems. Various types of reciprocal preference relations have been proposed, such as additive preference relations (also called fuzzy preference relations) [2, 11, 13, 14, 24], and multiplicative preference relations [3, 21–23]. It is well known that

Email addresses: ycdong@scu.edu.cn (Yucheng Dong), congcongli@stu.scu.edu.cn (Cong-Cong Li), chiclana@dmu.ac.uk (Francisco Chiclana), viedma@decsai.ugr.es (Enrique Herrera-Viedma)

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