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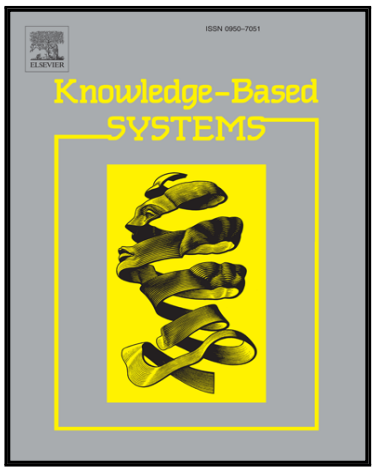

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On priority weights and consistency for incomplete hesitant fuzzy preference relations

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Abstract

The hesitant fuzzy preference relation (HFPR) is a useful tool for decision makers to elicit their preference information over a set of alternatives. In this paper, it is first proposed an approach to deriving a priority weight vector from an incomplete HFPR using the logarithmic least squares method. Based on the priority weight vector, the consistency index of an incomplete HFPR is defined, which calculates the average deviation between the priority weight vector and all elements of the incomplete HFPR. For an incomplete HFPR which is unacceptably consistent, an automatic algorithm is developed to improve the consistency. These results are then extended to propose a new procedure for group analytic hierarchy process to deal with multi-criteria group decision making problems. The feasibility and effectiveness of the proposed approaches are demonstrated by some numerical examples.

Keywords: hesitant fuzzy set, hesitant fuzzy preference relation, incomplete information, consistency, analytic hierarchy process

1. Introduction

Multi-criteria decision making (MCDM), which aims to select the optimal alternative(s) from a set of alternatives with respect to some predefined criteria, is a common activity for human beings and exists widely in different areas [1], such as supplier selection [2], partner selection [3], power system planning [4] and new product development [5]. Among different types of MCDM problems, MCDM based on pairwise comparisons in which there is a hierarchy structure of criteria has been widely studied [6]. For this type of MCDM problems, decision makers are usually required to elicit their preference information over alternatives through pairwise comparisons with respect to each criterion, based on which a priority weight vector and a ranking of the alternatives are then obtained. The Analytic Hierarchy Process (AHP), initially developed by Saaty [7], falls into the category of this type of MCDM problems.

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