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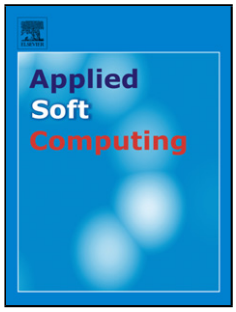

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Local feedback strategy for consensus building with probability-hesitant fuzzy preference relations

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Abstract

A consensus reaching process is an iteratively developed negotiation process designed to ensure that a mutual agreement is reached by decision makers. To incorporate distribution information of hesitant fuzzy sets, probability-hesitant fuzzy sets have recently been proposed. In the context of probability-hesitant fuzzy preference relations (PHFPR), this paper aims to provide a novel consensus reaching process for group decision making problems. By means of fuzzy preference relations, an optimization based consistency improvement process is proposed to deal with the inconsistencies in a given PHFPR. Consensus measures that are developed based on the distances between the individuals are computed on three levels: an alternative pair level, an alternatives level, and a preference relations level. An algorithm that adopts a local feedback strategy is designed to improve the consensus reaching process. The feedback strategy sequentially identifies the preferences with respect to the position and the anti-ideal individuals who need to change, after which the convergence of the proposed algorithm is proven. The novelty of the proposed strategy is that it avoids the need to compute the collective preference relations and recommendations are generated for the individuals in their original domains. Finally, some numerical examples taken from the literature are given to compare the proposed approaches with existing studies. The obtained results confirm the theoretical analysis and highlight the advantages of the proposed approaches.

Keywords:
Hesitant fuzzy sets (HFSs), Probability-hesitant fuzzy sets, Consistency, Consensus, Ideal individual

1. Introduction

Group decision making (GDM) has become increasingly popular for making important decisions at both societal and organizational levels. Numerous studies have found that groups tend to make better decisions than even the most highly skilled individual in that group [23, 62]. The individual in a group could mean agents, decision makers or experts in different contexts. In most GDM problems, as each person in the group has their own individual objectives and talents, they may have diverse opinions and incompatible ideas; therefore, obtaining group consensus is critical. In group ranking problems, the focus is also on identifying consensuses [5]. A consensus reaching process is therefore often imbedded in GDM before a selection process is implemented [20]. Franco et al. [15] reported some empirical evidences on how the 'need for closure' impacts on the consensus reaching processes. In general, a consensus process is defined as a dynamic, interactive group decision process coordinated by a moderator who plays a central role by providing feedback and assisting individual group members to gradually alter

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