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Title: An innovative TOPSIS approach based on hesitant fuzzy correlation coefficient and its applications

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Research Highlights

- Analyze drawbacks that the existing TOPSIS can not address negative value directly.
- The definition of two creative TOPSIS decision making factors.
- Four types relative closeness of the alternative to the ideal solution.

Abstract: The technique for order preference by similarity to ideal solution (TOPSIS) is one of the most popular and efficient methods in solving the multiple criteria/attribute decision making (MCDM/MADM) problems. However, the traditional TOPSIS can not deal with the information measures with negative value. Therefore, we develop an innovative TOPSIS in this paper based on a novel synthetic correlation coefficient between HFSs which lies in $[-1, 1]$ in statistical view and considers three characteristic factors of HFSs: the mean, variance and length. To construct the innovative TOPSIS, we creatively define two kinds of analogical factors: the similarity-like positive and negative correlation coefficient decision making factor and the distance-like positive and negative correlation coefficient decision making factor, which all lie in $[0, 1]$. These two analogical factors successfully transform the negative value in correlation coefficient to $[0, 1]$. Based on these two analogical factors, we further explore four types of relative closeness of the alternative with respect to the ideal solution which can be used to make the decision directly. We also provide the hesitant fuzzy MCDM method based on the innovative TOPSIS approach. Finally, two practical MCDM examples concerning energy policy selection and airlines quality evaluation are taken to demonstrate the implementation and feasibility of the innovative TOPSIS approach.

Key words: Innovative TOPSIS; Hesitant fuzzy correlation coefficient; Hesitant Fuzzy Sets (HFSs); Multiple criteria decision making (MCDM)

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