

Multiattribute decision making based on novel score function and the power operator of interval-valued intuitionistic fuzzy values

Deng-Cyun Chen

`M11115101@gapps.ntust.edu.tw`

April 11, 2023

Summary

Research Motivation

Because the MADM method proposed based on the IVIFV longitude function and the IVIFV weighted average operator in the fuzzy system has some shortcomings, so the district needs to develop a new MADM method to overcome.

Summary

Purpose

The purpose of this paper is to propose a new multiple attribute decision-making (MADM) method based on interval-valued intuitionistic fuzzy values (IVIFVs). The proposed method uses a novel score function and power operator to calculate the weights of alternatives for multi-attribute decision-making. The aim is to overcome the limitations of existing MADM methods and improve the accuracy and efficiency of multi-attribute decision-making.

Introduction

Method

Multiple attribute decision-making (MADM) is a method used to evaluate and rank alternatives based on multiple criteria or attributes. MADM methods typically involve assigning weights to each attribute and then calculating a score for each alternative based on its performance on each attribute. The scores are then combined to obtain an overall ranking of the alternatives

Introduction

In this paper, we propose a novel MADM method based on the proposed novel SF of IVIFVs and the power operator [1] of IVIFVs. The proposed SF of IVIFVs can overcome the drawbacks of the SFs of IVIFVs presented in [2]. Based on the proposed SF of IVIFVs, we propose a new MADM method to overcome the shortcomings of the MADM methods presents in [3]. The proposed MADM method is very useful for MADM in IVIF environments

Related work

In recent years, some MADM methods [4] [5] [6] [7] [8] have been proposed based on IVIFSs. However, the MADM methods presented in [4] [5] [6] [7] [8] have the following drawbacks:

- (1) Chen and Huang [9] pointed out that the MADM method presented in [4] has the shortcoming of obtaining unreasonable preference orders (POs) of alternatives in some circumstances.
- (2) Chen and Han [10] pointed out that the MADM method presented in [5] has the drawback that it cannot get the POs of alternatives in some cases since infinite loops occurred.

Related work

(3) The MADM method presented in [6] is not able to distinguish POs of alternatives and obtains unreasonable POs of alternatives in some situations.

(4) Chen and Huang [9] pointed out that the drawback of the MADM method presented in [7] is that it cannot obtain the POs of alternatives in some circumstances due to the “division by zero” problem occurred.

(5) Chen and Han [10] pointed out that the drawback of the MADM method presented in [8] is that it cannot obtain the POs of alternatives in some circumstances due to the “division by zero” occurred.

Therefore, a new MADM method needs to be developed to overcome the shortcomings of the MADM methods presented in [4] [5] [6] [7] [8]

Method

Step1

Transform each IVIF weight of a criterion into a crisp weight using a proposed formula. This step allows for a better reflection of the decision maker's relative importance of various criteria.

Method

Step2

Evaluate each criterion to determine its relative importance in the decision-making process. This involves assigning IVIF weights to each criterion.

Method

Step3

Calculate the score of each alternative on each criterion using a new score function. This step involves using the proposed score function to calculate the score of each alternative on various criteria.

Method

Step4

Convert scores into weights using a power operator. This step involves using a power operator to convert scores into weights, which better reflect the relative importance of various criteria.

Step5

Multiply the weights of each criterion and alternative to obtain final scores. This step involves multiplying the weights of each criterion and alternative to obtain final scores for each alternative. Based on these scores, alternatives can be ranked to obtain the optimal solution.

Conclusions

In this paper, a new multi-criteria decision-making method based on IVIF weights and a proposed score function was presented. The proposed method allows for a better reflection of the decision maker's relative importance of various criteria, which improves the efficiency and accuracy of the decision-making process. The results of the case study demonstrate that the proposed method outperforms other existing methods in terms of accuracy and efficiency. Furthermore, the proposed method is flexible and can be applied to various decision-making problems with different criteria. In conclusion, the proposed method provides an effective approach for solving complex decision-making problems with multiple criteria, and has great potential for.

Reference I

- [1] Z.S.Xu, "Methods for aggregating interval-valued intuitionistic fuzzy information and their application to decision making," *cir.nii.ac.jp*, 2007.
- [2] Z. yong Bai, "An interval-valued intuitionistic fuzzy topsis method based on an improved score function," *hindawi*, 2013.
- [3] Shyi.Ming.Chen, "Interval-valued fuzzy hypergraph and fuzzy partition," *Scopus*, 1997.
- [4] —, "Multiattribute decision making based on interval-valued intuitionistic fuzzy sets, pso techniques, and evidential reasoning methodology," *Scopus*, 2015.
- [5] —, "A new multiattribute decision making method based on multiplication operations of interval-valued intuitionistic fuzzy values and linear programming methodology," *ScienceDirect*, 2017.
- [6] —, "Multiattribute decision making using novel score function of interval-valued intuitionistic fuzzy values and the means and the variances of score matrices," *ScienceDirect*, 2021.

Reference II

- [7] —, “Topsis-based nonlinear-programming methodology for multiattribute decision making with interval-valued intuitionistic fuzzy sets,” *ScienceDirect*, 2010.
- [8] Zhitao.Zhao, “Multiple attribute decision making method in the frame of interval-valued intuitionistic fuzzy sets,” *IEEE Conferences*, 2011.
- [9] Shyi.Ming.Chen, “Multiattribute decision making based on interval-valued intuitionistic fuzzy values and linear programming methodology,” *ScienceDirect*, 2017.
- [10] —, “An improved madm method using interval-valued intuitionistic fuzzy values,” *ScienceDirect*, 2018.