

SCIV-Weight: A Novel Rank-Correlation-Based Objective Weighting Method Using Importance Vectors for MCDM

Serkan Akogul^{1,*}

¹Pamukkale University, Faculty of Science, Department of Statistics, Denizli, Türkiye

ABSTRACT

Determining criterion weights is a fundamental stage in Multi-Criteria Decision-Making (MCDM) problems, as the assigned weights directly influence the final ranking of alternatives. Existing objective weighting methods generally rely on different characteristics of decision data, such as criterion variability, information content, inter-criteria correlations, or the effects of criteria on the decision matrix. Although approaches such as CRITIC, Entropy, and MEREC are widely used in this field, there remains a need for alternative approaches that place the rank-based relationship between individual criteria and the overall importance structure of alternatives at the center of the weighting mechanism.

This study proposes a novel objective criterion weighting method, termed *SCIV-Weight (Spearman Correlation and Importance Vector-based Weighting)*. The proposed method is based on the Spearman rank correlation between each criterion and a *leave-one-out Importance Vector (IV)* constructed using the remaining criteria. This approach aims to reduce the self-correlation effect that may arise from the direct contribution of the evaluated criterion to the construction of its importance vector and to provide a more representative assessment of the relationship between each criterion and the overall performance structure of alternatives.

The performance of the proposed method is evaluated through a numerical example and comparative analyses with established objective criterion weighting methods. Furthermore, the resulting weights are integrated with the TOPSIS method to examine their effects on the ranking of alternatives. The study aims to introduce a novel objective weighting perspective to the criterion weighting literature by integrating rank-based relationships with an importance-vector-based approach.

Keywords: MCDM, Objective Criteria Weighting, SCIV-Weight

References

- [1] Altıntaş, F. F. (2024). A new approach for the measurement of criterion weights in the scope of multi-criteria decision making: spearman Rank Correlation-based Expanded CRITIC Method (SRCBECM). *Journal of Statistics and Applied Sciences*, (10), 10-34.
- [2] Ayan, B., Abacıoğlu, S., & Basilio, M. P. (2023). A comprehensive review of the novel weighting methods for multi-criteria decision-making. *Information*, 14(5), 285.
- [3] Diakoulaki, D., Mavrotas, G., & Papayannakis, L. (1995). Determining objective weights in multiple criteria problems: The critic method. *Computers & operations research*, 22(7), 763-770.
- [4] Keshavarz-Ghorabae, M., Amiri, M., Zavadskas, E. K., Turskis, Z., & Antucheviciene, J. (2021). Determination of objective weights using a new method based on the removal effects of criteria (MEREC). *Symmetry*, 13(4), 525.
- [5] Zavadskas, E. K., & Podvezko, V. (2016). Integrated determination of objective criteria weights in MCDM. *International Journal of Information Technology & Decision Making*, 15(02), 267-283.

*Corresponding Author's E-mail: sakogul@pau.edu.tr