A Modified CRITIC Method to Estimate the Objective Weights of Decision Criteria

ABSTRACT

In this study, we developed a modified version of the CRiteria Importance Through Intercriteria Correlation (CRITIC) method, namely the Distance Correlation-based CRITIC (D-CRITIC) method. The usage of the method was illustrated by evaluating the weights of five smartphone criteria. The same evaluation was repeated using four other objective weighting methods, including the original CRITIC method. The results from all the methods were further analyzed based on three different tests (i.e., the distance correlation test, the Spearman rank-order correlation test, and the symmetric mean absolute percentage error test) to validate D-CRITIC. The tests revealed that D-CRITIC could produce more valid criteria weights and ranks than the original CRITIC method since D-CRITIC yielded a higher average distance correlation, a higher average Spearman rank-order correlation, and a lower symmetric mean absolute percentage error. Besides, additional sensitivity analysis indicated that D-CRITIC has the tendency to deliver more stable criteria weights and ranks with a larger decision matrix. The research has contributed an alternative objective weighting method to the area of multi-criteria decision-making through a unique extension of distance correlation. This study is also the first to propose the idea of a distance correlation test to compare the performance of different criteria weighting methods.