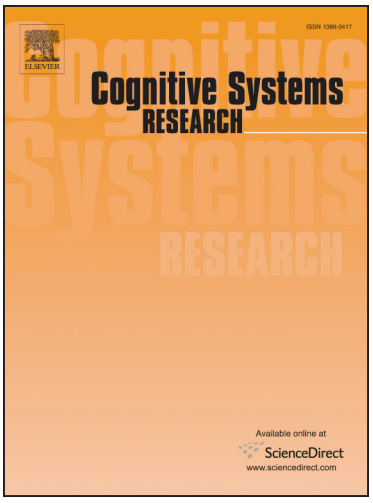

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Fuzzy Computation of Teaching Performance Based on Data Envelopment Analysis Method

Wenzhong Zhu, Muchun Wan, Yingying Zhou, Wentsao Pan*

1. Engineering, School of Business Guangdong University of Foreign Studies, Guangzhou, China
Corresponding Author's Email: 3300859561@qq.com

Abstract: Data Envelopment Analysis (DEA) is a system analysis method. It is suitable for evaluating the relative efficiency of Decision Making Units (DMU) with multiple input and output indicators, which is subject to no dimensional form of data and does not need to set the parameters. Subordinate colleges are an integral part of a university, and the university's comprehensive competitiveness can be improved only when each college reaches the optimal state of teaching performance. From the perspective of faculty structure, this paper constructs the evaluation system for the teaching performance of subordinate colleges. In the evaluation system, there are two fuzzy variables, employment quality and quality of enrollment of graduates, so the fuzzy DEA method is adopted. The introduction of fuzzy theory can well solve the problem of fuzzy numbers in input or output. The commonly used fuzzy numbers include triangular fuzzy numbers and trapezoid fuzzy numbers. The triangular one is used in this paper. The research results will help the university strengthen the understanding of subordinate colleges, which is of practical significance to improve the university's comprehensive competitiveness.

Keywords: Fuzzy theory; Triangular fuzzy number; Data envelopment analysis method; Teaching performance;

1. Introduction

Data mining has been widely applied in various fields [12-14], among them, data Envelopment Analysis (DEA) is a system analysis method. It is suitable for evaluating the relative efficiency of Decision Making Units (DMU) with multiple input and output indicators, which is subject to no dimensional form of data and does not need to set the parameters. Therefore, it is widely used in multiple research fields, such as evaluation of resource utilization efficiency [1], performance evaluation [2-3] of institutions of higher learning, environmental performance evaluation [4] and node importance ranking [5] in social network. Many scholars have also proposed a variety of derived forms of DEA based on specific research scenarios, such as rough DEA [6] and fuzzy DEA [7-8]. This paper discusses the application of fuzzy DEA-CCR model in the teaching performance evaluation of subordinate colleges of the university through examples.

In the traditional DEA model, input and output values are accurate. In reality, however, input or output values tend to be uncertain, such as the measurement of reputation and satisfaction of DMU, etc. The introduction of fuzzy theory can well solve the problem of fuzzy numbers in input or output. The commonly used fuzzy numbers include triangular fuzzy numbers and trapezoid fuzzy numbers. The triangular fuzzy numbers can be regarded as the special case of trapezoid fuzzy numbers, which are expressed in this paper as $\tilde{A} = (a_1, a_2, a_3)$. Where, a_1, a_2 and a_3 represent the lower limit value, principal value and upper limit value of $\tilde{A}$, respectively. In the fuzzy number set, these three values are not equal at the same time.

Generally speaking, the implementation of fuzzy DEA-CCR can be divided into four steps as below:

Step 1: Assuming that there are n DMUs (k=1,2,3,...,n), each DMU has g input indicators and t output indicators. The inputs and outputs of kth DMU contain fuzzy numbers, which are expressed as $\widetilde{x_{ik}}$(i=1,2,...,g) and $\widetilde{y_{rk}}$(r=1,2,..,t), and $\widetilde{x_{ik}}$=(x_{ik1}, x_{ik2}, x_{ik3}) and $\widetilde{y_{rk}}$=(y_{rk1}, y_{rk2}, y_{rk3}), respectively. At this time, the fuzzy DEA-CCR model is expressed as shown in Formula (1) [9-10]:

$$\min \theta$$

$$\text{s.t.} \sum_{k=1}^{n} \lambda_k \widetilde{x_k} + s^- = \theta \widetilde{x_0}$$

$$\sum_{k=1}^{n} \lambda_k \widetilde{y_k} - s^+ = \widetilde{y_0}$$

$$\lambda_k \geq 0, k \geq 1$$

$$\theta \text{ unrestraint}, s^+ \geq 0, s^- \geq 0$$