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Application of AHP FSE Method in the Network Course Quality Evaluation

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Abstract

In order to resolve a problem on the network course quality evaluation be affected by many complicated factors, combining with Analytic Hierarchy Process (AHP) and Fuzzy Synthetic Evaluation (FSE) is applied in it. Firstly, it makes a top-down analysis of the factors that affect the network courses and establishes a set of hierarchical factor structure with AHP. Then, it evaluates the single factor, including to determine the weight of each factor to decision-making with AHP and to calculate the influence degree of each factor with FSE. Finally, it gives a down-top comprehensive fuzzy evaluation until obtaining the final evaluation result. Its results showed that AHP FSE considered fully the factors' hierarchy and weight that affect the quality of network course. The Application of AHP FSE method can give an overall evaluation for the network course effectively.

Keywords: Network course; Analytic hierarchy process, AHP; Fuzzy synthetic evaluation, FSE; quality

1. Introduction

As the network course quality evaluation is affected directly by the knowledge level, cognitive ability and personal preferences, it is difficult to rule out completely the bias caused by human factors, and it cannot be described accurately with distinct fuzzy feature[1-2]. In addition, the influence on the network course of each target is not necessarily the same (the different weights). Therefore, considering these

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factors, this thesis conducts an overall exploration and research on network course quality evaluation based on AHP (Analytic Hierarchy Process)[3-4] and FSE (Fuzzy Synthetic Evaluation)[5] in the systems engineering theory.

2. Model of the network course quality evaluation

2.1. Mathematical description of the network course quality evaluation

The real number c can be used to define the network course quality , $c \in [0,1]$ and the bigger c is, the higher the quality is; Contrarily, it is lower. Suppose b_k in the target set B contains n-factors, that is $b_k = \{ b_{ki} \mid i = 1, 2, \cdots, n \}$. According to the factors, a mapping function $c_{ki} = f^{ki}(b_{ki})$ is established. In addition, each factor has different influences. Combining with various influences on the parent factors, we can calculate factor C according to $c_k = W^k \bullet C^k$, in which $W^k = (w_1^k, w_2^k, \cdots, w_n^k)$ is the weight of n factors for target k . Satisfying $0 \le w_{ki} \ge 1$, and $C^k = (c_{k1}, c_{k2}, \ldots, c_{kn})^T$ is the weight for target k.

Suppose the total number of hierarchical structure is l, and the total number of the corresponding weight vector is l too. The network course quality can be regarded as the interval mapping of the parameters to [0, 1]. The model can be described as:

$$\begin{aligned} C &= W^1 C^1 = W^1 (W^2 C^2 + f^1(B_1')) \\ &= W^1 (W^2 \bullet (W^l f^l(B_l') + f^{l-1}(B_{l-1}')) + \cdots + f^1(B_1')) \\ &= f^c(W, B) \end{aligned} \tag{1}$$

2.2. Quantitative of the evaluation criteria results

According to the mathematical description of the quality of the network course, quality C lies in [0, 1]. So, it is necessary to give the quantification and standardization for the structural fuzzy comprehensive evaluation, and unify to the same interval.

Suppose $U = \{u_1, u_2, \ldots, u_n\}$ is the set of n factors, called the factor set. Suppose $V = \{v_1, v_2, \ldots, v_m\}$ is the set of decisions known as the judge set . In general, the impact of various factors on the transaction is inconsistent, so the weight distribution factor can be regarded as fuzzy sets on U, denoted by $W = (w_1, w_2, \ldots, w_n) \in F(U)$, w_i(i=1,2,…,n), representing the weight factor. In addition, m decisions are not absolute, positive or negative, it should also be consolidated after the judge viewed as fuzzy set on V, denoted by $A = (a_1, a_2, \ldots, a_m) \in F(U)$, reflecting the kind of decision j-V in the share of the overall evaluation status. In summary, the fuzzy evaluation model has three basic elements:

(1) Factor set $U = \{u_1, u_2, \ldots, u_n\}$.(2) Evaluation set $V = \{v_1, v_2, \ldots, v_n\}$.(3) Single factor evaluation, namely fuzzy mapping:

$$\begin{cases} f : U \to F(V) \\ u_i \mid\to f(u_i) = (r_{i1}, r_{i2}, \cdots, r_{im}) \in F(V) \end{cases} \tag{2}$$

A fuzzy relationship can be induced by f:

$$R = \begin{bmatrix} f(u_1) \\ f(u_2) \\ \cdots \\ f(u_n) \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix} \tag{3}$$