

Scilab application in AHP decision-making analysis

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Abstract—T.L. A. Saaty in the United States in the 70s of this century put forward Analytical Hierarchy Process, referred to as AHP method, which is a combination of qualitative and quantitative analysis of the decision-making. It is a quantized and modal process for the complex system's decision-making process by decision-makers.

Here, A is called to judgement matrix, if we choose the weight vector $W = [W_1, W_2, \dots, W_n]^T$,

$$AW = \lambda W$$

$$AW = n \cdot W$$

The basic principles

The level of the basic principles of analysis can be used the following simple examples to illustrate and analysis.

Assume that there are n objects A_1, A_2, \dots, A_n , their

weights are credited to W_1, W_2, \dots, W_n . Compare the weights of all the subjects, with two subjects each time as follows:

	A_1	A_2	...	A_n
A_1	W_1/W_1	W_1/W_2	...	W_1/W_n
A_2	W_2/W_1	W_2/W_2	...	W_2/W_n
\mathbf{M}	\mathbf{M}	\mathbf{M}	\mathbf{M}	\mathbf{M}
A_n	W_n/W_1	W_n/W_2	...	W_n/W_n

If we use the matrix to express the weight of objects such mutual relations, that is:

$$\begin{pmatrix} W_1/W_1 & W_1/W_2 & \dots & W_1/W_n \\ W_2/W_1 & W_2/W_2 & \dots & W_2/W_n \\ \mathbf{M} & \mathbf{M} & \mathbf{M} & \mathbf{M} \\ W_n/W_1 & W_n/W_2 & \dots & W_n/W_n \end{pmatrix}$$

That is to say, W is the feature vector of A , λ is an eigenvalue according to the knowledge of linear algebra, it is not difficult to prove that λ is the only non-zero and the largest eigenvalue of A , and W is the corresponding eigenvector.

It suggests that the above-mentioned facts, if there is a group of objects we need to know their weight without scales, then we compare the weights of all the subjects with two subjects each time, and get the judgement ratio for each of the objects, and constitute the judgement matrix. According to this thought, in the Study of Geographical Sciences, we can come to the relative weight of the factors which can not be measured, as long as the judgement matrix, we can come to the relative weight of the factors. According to this thought, in the Study of Geographical Sciences, we can come to the relative weight of the factors which can not be measured, as long as the judgement matrix, we can come to the relative weight of the factors. According to this thought, in the Study of Geographical Sciences, we can come to the relative weight of the factors which can not be measured, as long as the judgement matrix, we can come to the relative weight of the factors.

Building model

A. Describe the Problem

Lanzhou city, located in the middle of the upper reaches of the Yellow River, is the capital of Gansu Province, and the province's political, economic, education and technology center. There is no doubt that the economic development of Lanzhou plays an important role in the whole province, even in the whole country. Following the depth development of reform and opening-up, how to seize the opportunity to play a regional advantage and promote the comprehensive development of Lanzhou's economy is a major policy decision that needs to be solved before the provincial and municipal leaders. In order to solve this problem, we must be guided by the market, combine with the city's natural, economic, social and technical conditions.

ne with favorable and unfavorable factors, and select a number of areas sort the level of the total order from top to bottom layers. For regional advantages and have high efficiency of the leading industries, then the highest level, the level of a single sort is the sort of its total economic take-off.

B. Establish the Hierarchy Model

- I The target layer (A): select the leading industry which can drive economic development in Lanzhou City.
- I Criteria layer (C) include the following three aspects:
 - (1) C1: market demand (including market demand for the status quo and long-term market potential).
 - (2) C2: effectiveness criteria (in this case the main consideration of the economic benefits of industry).
 - (3) C3: paly the regional advantages and use of resources reasonably.
- I Object Layer (P) include the following 14 industries
 - (1) P1: the energy industry
 - (2) P2: transportation industry
 - (3) P3: Metallurgical Industry
 - (4) P4: Chemical Industry
 - (5) P5: textile industry
 - (6) P6: Building Materials Industry
 - (7) P7: the construction industry
 - (8) P8: Machinery Industry
 - (9) P9: food processing industry
 - (10) P10: posts and telecommunications industry
 - (11) P11: appliances, electronics industry
 - (12) P12: Agriculture
 - (13) P13: tourism
 - (14) P14: Food Service

C. The Process of Model Computation

Based on the above model structure, on the basis of the experts' advices, we constructed judgement matrix A-C and C-P. Then we calculated the corresponding maximum eigenvalue, consistency index $CI = \left(\frac{I_{\max} - n}{n - 1} \right)$ and the random consistency ratio of the judgement matrix $CR = CI / RI$ (which corresponds to RI for the CI of the same order of the average random consistency index) using the various programming scilab matrix to determine. Finally we can get the level of a single sort. Using all levels of single-sort the results in the same level, we can calculate the weight values of all the elements for the previous level of the hierarchy, which is called the level of the total order. We need

To sum up, we can draw two basic conclusions as follows:

- I From the C layer sort results, the selection criterias of the leading industries in Lanzhou should consider the effectiveness of industry (mainly economic), take into account market demand and long-term market potential and play the regional advantages and the issue of rational use of resources.

$$\lambda_{\max}=15.65 \quad CI=0.127 \quad RI=1.58 \quad CR=0.0804 < 0.10$$

$$\lambda_{\max}=15.94 \quad CI=0.149 \quad RI=1.58 \quad CR=0.0943 < 0.10$$

$$\lambda_{\max}=15.64 \quad CI=0.126$$

$$RI=1.58 \quad CR=0.0797 < 0.10$$

- I From the P layer sort the results of the total, the priority the leading industries of Lanzhou City should be: P1 (energy industry) > P2 (transportation) > P4 (Chemical Industry) > P3 (Metallurgical Industry) > P5 (textile industry) > P7 (construction) > P11 (electrical appliances, electronics industry) > P8 (machinery industry) > P12 (Agriculture) > P6 (building materials industry) > P10 (posts and telecommunications sector) > P13 (tourism) > P14 (catering service) > P9 (food processing industry).

Keyword-AHP, scilab, decision-making.

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