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Research on the evaluation of route navigation environment based on blind number

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ABSTRACT

Blind number theory can effectively solve the uncertainty of the transaction, randomness, unpredictability, fuzziness, complexity, features, find out the various factors affecting the route navigable environment and to analyze the factors and screening, establish assessment index system of shipping routes environmental, determine each indexby AHP weight method, use the Delphi method (Delphi) to determine the risk level of each index, establish shipping routes environmental assessment model based on blind number theory. On the route navigable environment assessment, this paper draws routes navigable environmental risk rating and provides a reference for the development and utilization routes.

KEYWORDS

Folk financial; Blind number; Route navigation; Environment.

INTRODUCTION

Shipping routes environmental safety risks facing traditional security factors and non-traditional security threats. Routes navigable environment itself randomness, fuzziness, intellectual and other uncertainties not correct, it is more difficult measure; factors for maritime navigation safety is concerned, the relationship between the various factors is complex and cannot be achieved by one to quantify, so the route navigable environmental indicators for risk assessment is a problem. Due to security risk assessment information for each route navigation environment, indicators have unascertainedand it is blind information. Gray information, random information and unascertained information and so can the number of blind theory to express and deal with, more importantly, is blind number theory can also be used to express and deal with blind information. Thus, this paper establish blind number theory route navigation environment for analysis[1].

THETHEORY OVERVIEW OF BLIND NUMBER

Setting said set of real numbers, as unascertained rational set, G is rational gray number set.

Definition 1: Let $\alpha_i \in G$, $\alpha_i \in [0,1]$ and i = 1,2,...,n is as defined in the function G of gray:

$$f(x)=\begin{cases}\alpha_i & x=\alpha_i(i=1,2,\dots,\text{n})\\ 0 & x\notin\{\alpha_i(i=1,2,\dots,\text{n})\}\ \text{and}\ x\in G\end{cases}$$

If at that timethat $i \neq j$, $\alpha_i \neq \alpha_j$ and $\sum_{i=1}^{n}\alpha_i=\alpha, 0<\alpha\leq 1,$ the function f(x) is called a blind number, α_i order number n. Called f(x) in credibility, called f(x) of the total credibility α_i [2].

G * represents the set of one operation can be +,-, *, or any of a +. Blinding number:

$$A=f(x)=\begin{cases}\alpha_i & x=\alpha_i(i=1,2,\dots,\text{n})\\ 0 & x\notin\{\alpha_i(i=1,2,\dots,\text{n})\}\ \text{and}\ x\in G\end{cases}$$

$$B=y(x)=\begin{cases}\beta_i & y=\beta_i(i=1,2,\dots,\text{n})\\ 0 & y\notin\{\beta_i(i=1,2,\dots,\text{n})\}\ \text{and}\ y\in G\end{cases}$$

$$\begin{array}{cccccc} x_1 & x_1y_1 & \cdots & x_1y_j & \cdots & x_1y_n\\ \cdots & \cdots & & \cdots & & \cdots\\ x_i & x_iy_1 & \cdots & x_iy_j & \cdots & x_iy_n\\ \cdots & \cdots & & \cdots & & \cdots\\ x_m & x_my_1 & \cdots & x_my_j & \cdots & x_my_n\\ * & y_1 & \cdots & y_j & \cdots & y_n \end{array}$$

With the possible values for the A and B sides * matrix, $x_1, x_2, \dots, x_m$ and $y_1, y_2, \dots, y_m$ each represent a possible sequence of values A and B, the two straight lines perpendicular to each other is called the vertical and horizontal

$$\begin{bmatrix} x_1y_1 & \cdots & x_1y_j & \cdots & x_1y_n\\ \cdots & \cdots & \cdots & \cdots & \cdots\\ x_iy_1 & \cdots & x_iy_j & \cdots & x_iy_n\\ \cdots & \cdots & \cdots & \cdots & \cdots\\ x_my_1 & \cdots & x_my_j & \cdots & x_my_n \end{bmatrix}$$

Array called A and B may value * under * matrix operations, referred to the possible values * matrix; said

$$\begin{array}{cccccc} \alpha & \alpha_1\beta_1 & \cdots & \alpha_1\beta_j & \cdots & \alpha_1\beta_n \\ \cdots & \cdots & & \cdots & & \cdots \\ \alpha_i & \alpha_i\beta_1 & \cdots & \alpha_i\beta_j & \cdots & \alpha_i\beta_n \\ \cdots & \cdots & & \cdots & & \cdots \\ \alpha_m & \alpha_m\beta_1 & \cdots & \alpha_m\beta_j & \cdots & \alpha_m\beta_n \\ * & \beta_1 & \cdots & \beta_j & \cdots & \beta_n \end{array}$$

It is B and A on the reliability of the product matrix band edge, respectively, $\alpha_1, \alpha_2, \ldots, \alpha_m$ and $\beta_1, \beta_2, \ldots, \beta_m$ the reliability of the tail sequences A and B.

$$\begin{bmatrix} \alpha_1\beta_1 & \cdots & \alpha_1\beta_j & \cdots & \alpha_1\beta_n \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \alpha_i\beta_1 & \cdots & \alpha_i\beta_j & \cdots & \alpha_i\beta_n \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ \alpha_m\beta_1 & \cdots & \alpha_m\beta_j & \cdots & \alpha_m\beta_n \end{bmatrix}$$

It is called A on B's credibility matrix, referred to as the credibility of the product matrix.

The possible values *of the elements of the matrix A * and B are arranged in ascending order according to: $\overline{x}_1, \overline{x}_2, \ldots, \overline{x}_i,$ where the same elements counted as one. If $\overline{x_i}$ the possible values in the matrix * s, a different position, the reliability of the elements of the product matrix corresponding to the position and referred to as $\overline{\gamma}_i$, a sequence $\overline{\gamma}_1, \overline{\gamma}_2, \ldots, \overline{\gamma}_i$ can be obtained, so that[3]:

$$\varphi(x) = \begin{cases} \overline{\gamma}_i & x = \overline{x}_i (i = 1, 2, \ldots, \text{t}) \\ 0 & x \notin \{\alpha_i (i = 1, 2, \ldots, \text{t})\} \; and \; x \in G \end{cases}$$

$\varphi(x)$ isKnown as the blind number of A and B * operator, denoted by –

$$A * B = f(x) * g(y) = \begin{cases} \overline{\gamma}_i & x = \overline{x}_i (i = 1, 2, \ldots, \text{t}) \\ 0 & x \notin \{\alpha_i (i = 1, 2, \ldots, \text{t})\} \; and \; x \in G \end{cases}$$

Where, during the interval required for the division $y_i (j = 1, 2, \ldots, \text{n})$ does not contain zero. Set A, B, C is the number of the blind, the blind number of operators has the following properties:

$$A + B = B + A;$$
$$A * B = B * A;$$
$$(A + B) + C = A + (B + C);$$
$$(A * B) * C = A * (B * C).$$

THE BLIND NUMBER MODEL OF ROUTE NAVIAGTION ENVIRONMENT

Is a measure of the weight of each factor in determining the overall assessment of the impact assessment of the extent of the target, the factors weighting coefficient "is one of the key aspects of navigable environmental assessment, can directly affect the outcome of routes navigable environment. Weight values to determine the impact of factors there are many methods commonly used methods are the Delphi method (Delphi) and Analytic Hierarchy Process (AHP).

Since the route navigable environmental assessment involves many factors. Analytic Hierarchy Process (AHP) has the practicality[4], simplicity, clear, systematic, and other characteristics, the route navigable environmental assessment, in order to be able to accurately and reasonable, objective assessment of the impact of various factors on the navigation environment, we use levels analysis Process (AHP) to determine the weight of each factor. The basic steps multilevel analysis process (AHP) is[5]:

(1) Hierarchical model construction system problems. AHP in the analysis of complex problems, the first departure from the level characteristic of the system, with a hierarchical model that describes the relationship between the factors of the issues involved and each other[6]. Hierarchical model should include the target layer (typically contains only one element, usually the focus of the overall goal or problem of the system), guidelines layer (arrangement used to measure whether the objectives of the assessment criteria and standards) and factor layer (influential objective assessment of the composition of each factor).

(2) The establishment of judgment matrix to calculate the relative weights, which is also known as single-level sorting through the evaluation index for the n pairwise comparison and construct a reflection of the degree of importance between the two judgment matrix.

TABLE 1：The compare standards of the important degree about the index in the evaluation system

Scale	meaning
1	In same level
3	One is more important in a bit level
5	One is more important in a larger level
7	One is more important in a very larger level
9	One is more important in a huge level
2,4,6,8,10	Take the median

As shown in TABLE 1, assess the target set H_k for the same indicators are directly relatedwith $w_1, w_2, w_3, \ldots, w_n$. Assumed H_k as a criterion in the objective, comparative indicators of the importance of indicators w_i and w_j, through expert assessment judgment matrix is constructed as follows:

$$P = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \ldots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \ldots & w_2/w_n \\ \ldots & \ldots & \ldots & \ldots \\ w_n/w_1 & w_n/w_2 & \ldots & w_n/w_n \end{bmatrix}$$

Where, P_{ij} is the importance of w_i and w_j to H_k

$$\begin{cases} P_{\text{ij}} = 1 \quad \text{when i=j} \\ P_{\text{ij}} = \dfrac{1}{b_{ij}} \quad \text{when } \text{i} \neq \text{j} \\ P_{\text{ij}} > 0 \ \text{when i=j=1,} \ldots, n \end{cases}$$

If use the importance of the vector $\begin{bmatrix} w_1 \\ w_2 \\ \ldots \\ w_n \end{bmatrix}$ to rightly multiply P, we get[7]:

$$PW = \begin{bmatrix} w_1/w_1 & w_1/w_2 & \dots & w_1/w_n \\ w_2/w_1 & w_2/w_2 & \dots & w_2/w_n \\ \dots & \dots & \dots & \dots \\ w_n/w_1 & w_n/w_2 & \dots & w_n/w_n \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \dots \\ w_n \end{bmatrix} = nW$$

That is PW=nW. By matrix theory shows, n is the characteristic value of P, and is the largest eigenvalue $\lambda_{\max}$, w is the characteristic corresponding to the maximum value of n eigenvectors. Easy to see that the feature vector method should first determine the maximum eigenvalue $\lambda_{\max}$ of judgment matrix; then calculate the feature vector $\lambda_{\max}$ corresponding to w, w of feature vectors are normalized according to the formula $w' = \frac{w_i}{\sum w_i}$, the feature vectors obtain $w' = (w_1', w_2', \dots, w_n')^T$. That is, $w' = (w_1', w_2', \dots, w_n')^T$ is for the purposes of the level indicators $w_1, w_2, w_3, \dots, w_n$ of H_k weight[8].

(3) Consistency checking. People in the complex issues of the factors involved in the pairwise comparison, it is impossible to achieve complete consistency of judgment and there will always be a certain degree of estimation error. This will lead to the eigenvalues and eigenvectors judgment matrix also with bias, in the judgment matrix obtained maximum eigenvalue $\lambda_{\max}$ [9]; post and its corresponding feature vectors $w' = (w_1', w_2', \dots, w_n')^T$, but also need to check the consistency of judgment matrix. Order to determine the matrix P n, consistency test indicators; random consistency index for RI; judgment matrix usually higher order n, the estimated deviation increases, consistency it worse, so the higher-order inspection judgment matrix should be relaxed requirements. For this introduction Stochastic RI value as a correction. Random consistency index:

$$CI = \frac{\lambda_{\max} - n}{n-1}.$$

TABLE 2： The value of RI

N=1	N=2	N=3	N=4	N=5	N=6	N=7
0	0	0.58	0.9	1.12	1.26	1.36
N=8	N=9	N=10	N=11	N=12	N=13	N=14
1.41	1.46	1.49	1.52	1.54	1.56	1.58

By measuring the consistency of judgment matrix formula $CR = \frac{CI}{RI}$, generally at the time $C.R. < 0.1$, can be considered the consistency of the matrix P is able to accept. Otherwise need to readjust the matrix elements P value.

(4) the level of the total order. Hierarchical ordering is calculated based on the total level of single-sort the results obtained by a combination of weights, all the indicators in the calculation of the right to the same level of the target layer from the upper layer by layer down weight should be. It has been calculated based indicators $\psi_K = (w_{1K}, w_{2K}, \dots, w_{nK})^T$ relative to the total weight m target weight vector for the first K+1 layer has a first layer of n elements.

(5) Total level sorting consistency test. The total level of consistency index sorted is $CI' = \sum_i^m a_i I_i$ and CI' isthe corresponding B-level judge Moments an array of consistency index $RI' = \sum_{i=1}^m a_i RI_i$; always sort of random consistency index level is the level for the corresponding B in judgment matrix consistency index. By measuring the consistency of judgment matrix formula $CR' = \frac{CI'}{RI'}$, generally when CR' <0.1, the overall level can be considered sort of consistency is able to accept. Otherwise need to re-adjust judgment matrix.

In route navigation environment analysis, evaluation indicators to assess, using the Delphi method (Delphi), were evaluated by a number of experts, while index values to be determined, is a comprehensive reflection of the expert score.

Because cognitive behavioral experts have unascertained, which can be used unascertained rational or blind number to represent the results of the assessment of experts, called the expert advice uncertainty quantification.

Rate of credibility, namely trustworthiness of experts, to some extent reflects the expert authority in the field[10]. Most trusted credibility as an expert, the most untrustworthy expert credibility is zero, if the credibility of the expert group $E_1, E_2, \ldots, E_N$, respectively, the $\overline{\alpha_i}, \overline{\alpha_2}, \ldots, \overline{\alpha_n}$ $\alpha_i = \dfrac{\overline{\alpha_i}}{\overline{\alpha_i} + \overline{\alpha_2} + \ldots + \overline{\alpha_n}}$

Where, E is the expert of Integrated credibility on the group $E_1, E_2, \ldots, E_N$.

The definition of each evaluation index is divided into "safe, safer, general, more dangerous and dangerous" five levels. Experts estimate range for evaluation index is[0, 100], in which (80, 100] considered a safe level (60, 80] considered a relatively safe level (40, 60] considered the ordinary level (20, 40] considered to be more dangerous levels, 0, 20] considered dangerous levels. Experts Group for each assessment indicators of the size of the estimate scores across grade scoring. Assuming navigable route there are n assessments of the environmental assessment indicators, $I = \{I_1, I_2, \ldots, I_N\}$ expert scoring is as shown in TABLE 3:

TABLE 3：The score table of expert groups

	E1	E1	……	En
I1	[a11,b11]	[a12,b12]	……	[a1n,b1n]
I2	[a21,b21]	[a22,b22]	……	[a2n,b2n]
……	……	……	……	……
In	[an1,bn1]	[an2,bn2]	……	[ann,bnn]

Section J of experts to assess the likelihood of the size of I index gives an estimate. Because even though the authority of experts in this field, there is a certain understanding of each evaluation index, but experts point to give a single value for each evaluation index estimate is unrealistic, it may not be accurate, in order to enable experts to assess the results more accurate, you can make an expert assessment index gives an assessment of the range.

CONCLUSION

Navigational technology environment indicatorsis relatively scarce and in the human environment, the international community is still relatively lack of information on the region which lead to the route with concurrency and utilization rules, causing many countries to compete on routes sovereignty, harm the environment safe navigation routes. The route in the route selection is affected by sea ice thickness and intensity of ice and in the choice of channel, we can avoidice while you can try to choose high security fairways.

This paperestablished ablind numbertheory and assessed thelevel ofenvironmental safety ofnavigableroute, determined the securitylevel ofroutenavigationenvironment and according to shipping routesenvironment in varioussecurity levels, this paper proposedstrategiesforChinaroutenavigation environment and offereda referencevaluefor routesdevelopment and utilization and ourmerchant shipscan sailin thevarious part of the wordas early as possible. This paper gave a theory to evaluate the navigation environment, the simulation or calculate results, however, are needed if we want to have a thorough analysis.

REFERENCES

[1] Yohei Sasakawa; *Ship& Ocean Foundation,* November, **1(2)**, 7-15 **(2001)**.
[2] L.Burg; *Journal of Delft University of Technology,* June, **3(1)**, 31-40 **(2007)**.
[3] ChengtaoYu; *Pacific Journal,* February, **1(12)**, 38-39 **(2011)**.
[4] Malai Cao; *Journal of Dalian Sea Maritime University,* April, **18(4)**, 16-169 **(2001)**.
[5] Guang Mao; *Journal of Ocean University of China,* April, **27(1)**, 81-101 **(2011)**.
[6] Li Zhang; *Journal of Ocean University of China,* June, **12(1)**, 16-22 **(2012)**.
[7] Yue Dong; *Coast Engineering,* March, **12(1)**, 16-23 **(2001)**.
[8] Guoping Tao; *Journal of Wuhan University of Technology,* March, **5(3)**, 19-21 **(2002)**.
[9] Hui Wu; *Journal of Wuhan University of Technology,* February, **2(3)**, 90-97 **(2011)**.
[10] Long Zhong; *Ship& Ocean Foundation*, February, **3(1)**, 18-20 **(2005)**.