Grey comprehensive evaluation of ship safety risk assessment

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Abstract

Due to the sea can be affected by various factors. First of all, the greatest influence or man-made factors, and the influence of human factors is not controlled, can only try our best to narrow, but also for personnel outside factors ignored, so this article mainly is to factors other than human factors are analyzed and summarized. There are a lot of analysis method can be solved today, such as the Bayesian and Neural network, etc., but these methods are only on the class of situation analysis and the classification, so for the shipping of the big data type, can using AIS data and system classification analysis results.

Keywords

Grayscale analysis, Ocean Quantum Number, Influencing factors, AIS.

1. Introduction

Anthropogenic interventions and hydrological-risk phenomena in the fluvial-maritime delta of the Danube [1]. The attacks have taken place in the gulf of Aden, the Arabian sea and the northern Indian Ocean, according to the best protection management practices compared to Somali pirates (BMP), affecting all shipping in the region. The UN security council has changed this issue the attention to crack down on piracy, puts forward the requirements in the national flag, port and coastal states have the victim and criminal pirates off the coast of somalia anti-piracy operation cooperation. Security council has passed several about maritime piracy that is important to the United Nations security council resolution 1816, 846 and 1851. This is unprecedented in their level of authority awarded the international community to deal with in the field of Marine threat [2]. Safety management is a branch of organizational management that aims to develop, plan, implement and follow preventive measures and reduce risks, environment, or property related to personal safety. In the maritime area, the international safety management (ISM) code provides the safety requirements management system (IMO, 2013). For all ships belonging to the ship, ISM rules are mandatory[2].

2. The theoretical basis of ship safety navigation assessment

2.1 The Importance of Safe Navigation of Ships

In recent years, Maritime traffic with the development of the tourism industry, Internet trade is frequent, maritime traffic volume is increasing. In some important port is important to the traffic, and sailing safety is the focus of research. It is also necessary to be safe in the north channel of Yangtze river estuary. As more technical development leads to more ship traffic, It is now the subject of study to avoid collision and expedite transport. In order to better help the shore-based personnel to better coordinate and manage the safety of the navigable waters, can evaluate, to the wind flow, accident, the ship itself factors, and so on and so forth will lead to the influence of maritime accidents can also lead to increased gradually, this shows the importance of safety assessment.

2.2 The Theoretical Basis of Grey Correlation

In cybernetics, people often express information in colors or shades of color. In grey theory, "black" represents the unknown, "white" indicates the complete clarity of the information. The system known as the black system, known as the black system, is known as the white system. The system for information ambiguity is called grey system [1]. In the grey system, information can be uncertain or not quantitative. The grey theory is mainly to determine the unknown information in the system by

knowing information. Since black and white are against each other, gray is somewhere in between. We can define black as 0 and white as 1.

Correlation analysis was quantified in grayscale analysis

In correlation analysis, the reference data column can be defined as X0, so it can be represented as $X_0=\{X_0(1), X_0(2), \cdots X_0(n)\}$

For other related comparisons (subfactor time series) is often recorded as Xi , then it can be expressed as $X_i=\{X_i(1), X_i(2), \cdots X_i(n)\}$

Compared with the correlation between X_0 and X_i, the differences between each curve and the comparison curve are compared.

3. Based on grey relational degree model

3.1 Analysis of Problems

In the channel of changjiang estuary, due to the backsilting, reef, throughput, external hydrology, temperature, wind direction and other conditions directly affect the voyage of the quantum number of the sea. For the ship itself, there is also the track bandwidth, instantaneous velocity, offset distance, etc., the human factors have the crew quality, the sailor quality, the captain's technology and so on affect the ship's navigation. So for ship operation factors can be represented by itself, can be set to X0 for track bandwidth, instantaneous speed, the maximum spacing, the minimum spacing, component of the pressure is variable can be set up for Xi.

3.2 Assumptions of The Model

The relational degree hypothesis model is R=E×W

R=[r1, r2, r3, ...rm]T To evaluate the result vectors of m

W=[w1, w2, w3, ...wn]T The weight distribution vector for n evaluated indexes, $\sum_{j=1}^{n} w_j$ E is the

evaluation matrix of each index

$$E=\begin{bmatrix} \xi_1(1) & \xi_1(2) & \cdots & \xi_1(n) \\ \xi_2(1) & \xi_2(2) & \cdots & \xi_2(n) \\ \vdots & \vdots & & \vdots \\ \xi_m(1) & \xi_m(2) & \cdots & \xi_m(n) \end{bmatrix} \quad (1)$$

ξi（k）is the correlation coefficient between the k index and k optimal index of the issue.

3.2.1 Determine the Optimal Set of Indicators (F *)

$$F^*=[j_1^*,,j_2^*,...,j_n^*] \quad (2)$$

In the formula, jk* (k = 1, 2,... N) the optimal solution for the k th index. The optimal solution can be the optimal solution of the various parties.

After selecting the optimal solution index, the original value of the KTH index can be constructed.

$$D=\begin{bmatrix} j_1^* & j_2^* & \cdots & j_n^* \\ j_1^1 & j_2^1 & \cdots & j_n^1 \\ \vdots & \vdots & & \vdots \\ j_1^m & j_2^m & \cdots & j_n^m \end{bmatrix} \quad (3)$$

In the formula: the original value of the j_k^1 index in the ith scheme

3.2.2 Normalized Processing

Due to the differences in the magnitude of data, the comparison can not be made, so the normalized treatment is used to normalize the processing.

$$C_k^i = \frac{j_k^i - j_{k1}}{j_{k2} - j_k^i} \quad i=1, 2, ..., m;k=1, 2, ...,n \tag{4}$$

$$c=\begin{bmatrix} c_1^* & c_2^* & \cdots & c_n^* \\ c_1^1 & c_2^1 & \cdots & c_n^1 \\ \vdots & \vdots & & \vdots \\ c_1^m & c_2^m & \cdots & c_n^m \end{bmatrix} \tag{5}$$

3.2.3 Comprehensive Evaluation Results

$$\xi_i(k) = \frac{\min\limits_i \min\limits_k |c_k^* - c_k^i| + \rho \max\limits_i \max\limits_k |c_k^* - c_k^i|}{|c_k^* - c_k^i| + \rho \max\limits_i \max\limits_k |c_k^* - c_k^i|} \tag{6}$$

$\rho \in [0, 1]$, $\rho = 0.5$

3.2.4 Result

$$r_i = \sum_{k=1}^{n} W(k) \times \xi_i(k) \tag{7}$$

4. The Example Analysis

For gray analysis concluded that the analysis summary and comparison of for the study of the Yangtze estuary navigation segment, in and out of the port is important, for the port safety management and maintenance of all play an important role, for Marine quantum number column, there are a lot of containers and cargo transport, through statistical comparison, Marine quantum number as a passenger ship is more need to port the safety demonstration and testing.see Table 1.

Table 1 Quantum of the sea

x(mile)	y(mile)	X(mile)	Y(mile)	Minimum transverse distance(m)	Maximum transverse distance(m)	Track bandwidth (m)	Wind pressure difference	Instantaneous speed (section)
6268.935202	1967.928681	0.000620589	1.329972	268.9494391	300.9909329	32.04149388	-2.724489303	2.613029121
6268.939791	1967.927813	0.004380029	1.329228	268.8044045	300.8234377	32.01903319	-2.711489303	2.652942041
6268.944377	1967.926939	0.008129211	1.328478	268.6749918	300.6698347	31.99484292	-2.697489303	2.636440476
6268.948973	1967.926064	0.011888653	1.327728	268.5421673	300.51109	31.96892266	-2.682489303	2.597927934
6268.953557	1967.925196	0.015642966	1.326984	268.4005374	300.3435376	31.9430002	-2.667489303	2.538093455
6268.958151	1967.924329	0.019407538	1.32624	268.2541371	300.172941	31.91880393	-2.653489303	2.499144191
6268.962747	1967.923454	0.023166982	1.32549	268.1192749	300.0173376	31.89806275	-2.6414893	2.482384124

Due to the ocean quantum number and other cargo ships and container ships, the difference is greater or instantaneous speed. In fact, the key factor is that human factors dominate, but this can only be managed by management. It reveals that human-related mistakes are very important and result in

long-term economic losses to operators caused by disruption of offshore operations [3]. Analysts said the lack of equipment maintenance and maintenance operations during the port equipment, machinery and equipment to further aggravate the pressure on these ports under dynamic operating environment. Therefore, the control of human factors behind the need to protect other related issues countermeasures to ensure other accurate and reliable in order to more security issues.

5. Future Countermeasure

There is a random risk of uncertainty. The risks and uncertainties associated with navigational navigation of ships at sea and the methods of development are applied to workable solutions. Such knowledge is crucial to safety analysts and policy makers Organizational strategies or measures will enhance the robustness of the unpredictable operation of individual port processes. The use of personal beliefs depends on the analyst's expertise, knowledge of the subject and experience on the operation of the system. Rationale The use of belief levels is the result of human decision making including ambiguity, uncertainty and imprecision. For human safety that can be controlled already has to be perfect, but for other mechanical controllable factors must be strengthened. Therefore, the control of instantaneous speed and direction of navigation in the machinery must be particularly strengthened.

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