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Research Article

Coastal Ecological Environment Monitoring and Protection System Based on Multisource Information Fusion Decision

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With the problem of nuclear leakage being concerned by more and more industries, the research of coastal ecological environment monitoring has become more and more important. Therefore, it is necessary to study the current unsystematic coastal ecological environment monitoring and protection system. Aiming at the accuracy of feature fusion and representation of single short environment information, this paper compares the classification effects of the three fusion methods on four classifiers: logistic regression, SVM, random forest, and naive Bayes, to verify the effectiveness of LDA and DS model fusion and determine the consistency vector representation method of short environment information data. This paper collects and analyzes the coastal data in recent years using multisource information fusion decision-making. In this paper, DS (Dempster Shafer) evidence algorithm is used to collect the data of coastal salinization degree and air relative humidity, and then, the DS feature matching model is introduced to fuse the whole index system. The method in the article completes the standardized and standardized processing of monitoring data digital conversion, quality control, and data classification, forms interrelated four-dimensional spatiotemporal data, and establishes a distributed, object-oriented, Internet-oriented dynamic management real-time and delayed database. Finally, this paper carries out tree decision processing on the coastal ecological environment monitoring data of multisource information fusion, to achieve the extraction and intuitive analysis of special data, and puts forward targeted protection strategies for the coastal ecological environment according to the data results of the DS algorithm. The research shows that the number of indicators in multisource information fusion in this paper is 16, a total of 3251 data, 2866 meaningful information, and 1869 data including ecological cycle. These data are the results of the collection of multi-information data. Based on the multilevel nature of the existing marine environment three-dimensional monitoring system, the study established a comprehensive resource-guaranteed framework and divided it into four levels according to the level of the marine monitoring system: country, sea area, locality, and data access point. In specific analysis, the guarantee resources involved in each level are introduced. On the basis of in-depth analysis of the requirements of the marine environment three-dimensional monitoring system operation guarantee and the guarantee resource structure, the marine environment three-dimensional monitoring operation comprehensive guarantee system is described from the internal structure and the external connection. The DS algorithm extracts the status information resources of various marine environment three-dimensional monitoring systems, through the interaction of various subsystems, realizes the operation and maintenance of the monitoring system, and provides various technical supports such as system evaluation and failure analysis. After multisource information fusion and decision-making, it is obtained that the index equilibrium module in the DS algorithm in this paper is 0.52, the sensitivity is 0.68, and the independence is 0.42. Among them, the range of sensitivity is the largest. In the simulation results, the eco-economic coefficient can be increased from 12% to 36%. Therefore, using the method of multisource information fusion for quantitative index analysis can provide data support for coastal ecological environment detection, to establish a more perfect protection system.

1. Introduction

With the development of the marine economy and the intensification of breeding activities, the coastal ecological environment is deteriorating day by day, resource destruction and water pollution are serious, and disasters such as red tides and Enteromorpha are frequent. The traditional collection of coastal resources and environmental background data is still in a semimanual and semiautomatic state, scientific equipment and detection methods are not mature enough, and imported equipment and complete systems are very expensive. In China, the research on the application of SAR (synthetic aperture radar) images to the extraction of surface feature information in the island coastal zone started late, but good results have also been achieved. Facing the current coastal ecological disaster risk, there is a contradiction between improving the fortification standard of protective facilities and the existing urban residential density and development needs in the coastal zone of the Pearl River Delta. Based on the experience and lessons of the earthquake and tsunami in Jidong, Japan, this paper puts forward the coastal disaster response planning strategy of combining prevention and reduction, which can be used for reference to China.

At present, the main technical means of marine environmental monitoring in my country is the field sampling experiment analysis method, and the real-time and continuity of the data is poor. However, the existing coastal deep-water exploration buoys are generally fixed at a certain position for many years, and the detected data is covered by points and partial coverage, which lacks representativeness. Many scholars use SAR image analysis to study the coastal ecological environment. For example, Wei uses a complex neural network to classify polarimetric SAR, which has achieved good results. Based on the idea of Strassen matrix multiplication, it reduces the training time by reducing the amount of calculation of convolution neural network, which has achieved good results [1]. Law proposes a deep supervised compression neural network to extract ground object information from SAR images. The supervision and punishment mechanism of the network can fully mine the relevant information between features and labels. Compression constraints can enhance the robustness of the network and have better classification performance compared with traditional methods [2]. Rochman et al. introduce the active learning method to verify the effectiveness and feasibility of active learning for feature information extraction through experiments on the full polarization SAR data of the coastal zone of Washington County, North Carolina [3]. Besseling et al. apply the sparse self-encoder to the ground feature classification of polarimetric SAR. This method can learn multilevel features and improve classification accuracy [4]. Fadare et al. use the improved FCM algorithm combined with Claude Pottier decomposition to explore the application ability of SAR image in Jiangsu coastal beach classification [5].

In recent years, scholars have also proposed acceleration methods based on cloud computing. For example, Gigault et al. use the polarization features extracted by Freeman decomposition and cloud Pottier decomposition to construct a feature set combined with Shannon entropy and extract deep features through self-encoder to make the data more separable. The research results show that the introduction of Shannon entropy can significantly improve the efficiency of seawater. Distinguish different ground features such as beach and mudflat, to effectively distinguish different island features in full polarization SAR images [6]. El Hadri et al. construct a convolutional neural network with overlapping denoising and automatic coding to realize the classification of coastal ecological objectives [7]. Wagner and Reemtsma use a convolution neural network based on complex contour wave to extract ground feature information in San Francisco Bay area, approximate the images to be classified in different directions and scales, and obtain a more sparse representation of SAR images, with an overall accuracy improvement of 5.29% [8]. The influence of lime contrast sample and slice size on the classification result verifies the effectiveness of convolutional neural network applied to SAR ground object classification [9]. Cheung and Fok use a convolutional neural network to classify the five target datasets of port, an oil tanker, cargo ship, offshore platform, and wind turbine provided by TerraSAR-X high-resolution image and has been widely used [10]. However, how to integrate short environmental information with coastal zone ecological data description and image description, to give a more accurate vectorial representation, to better serve coastal zone ecological construction, has not been seen in relevant research.

In this paper, the multisource information fusion decision-making method is used to collect and analyze the recent coastal data. In this paper, the DS evidence algorithm is used to collect the data of coastal salinization, relative humidity, and other indicators, and a DS function matching model is introduced to cover the whole index system for integration. Finally, this paper uses the multisource information fusion of coastal ecological monitoring data for tree decision-making to realize the extraction and intuitive analysis of special data. Combined with the data results of the DS algorithm, this paper puts forward the protection mechanism of coastal ecological environment protection.

2. Experiments and Methods

2.1. Research Content. Taking the planning countermeasures of postdisaster reconstruction, the laws and policies extended to the whole country, and the diversified implementation of local governments as the analysis context, this paper extracts the key planning countermeasures of disaster prevention and reduction in the coastal zone of Japan after the East Japan earthquake and provides the overall idea, specific practical disaster prevention, and reduction countermeasures for the ecological disaster prevention and reduction planning of the coastal zone of the Pearl River Delta. The multiagent cooperation mechanism puts forward optimization suggestions from three aspects.

2.2. Experimental Setup and Case Study. Aiming at the accuracy of feature fusion and representation of single short environment information, this paper compares the classification

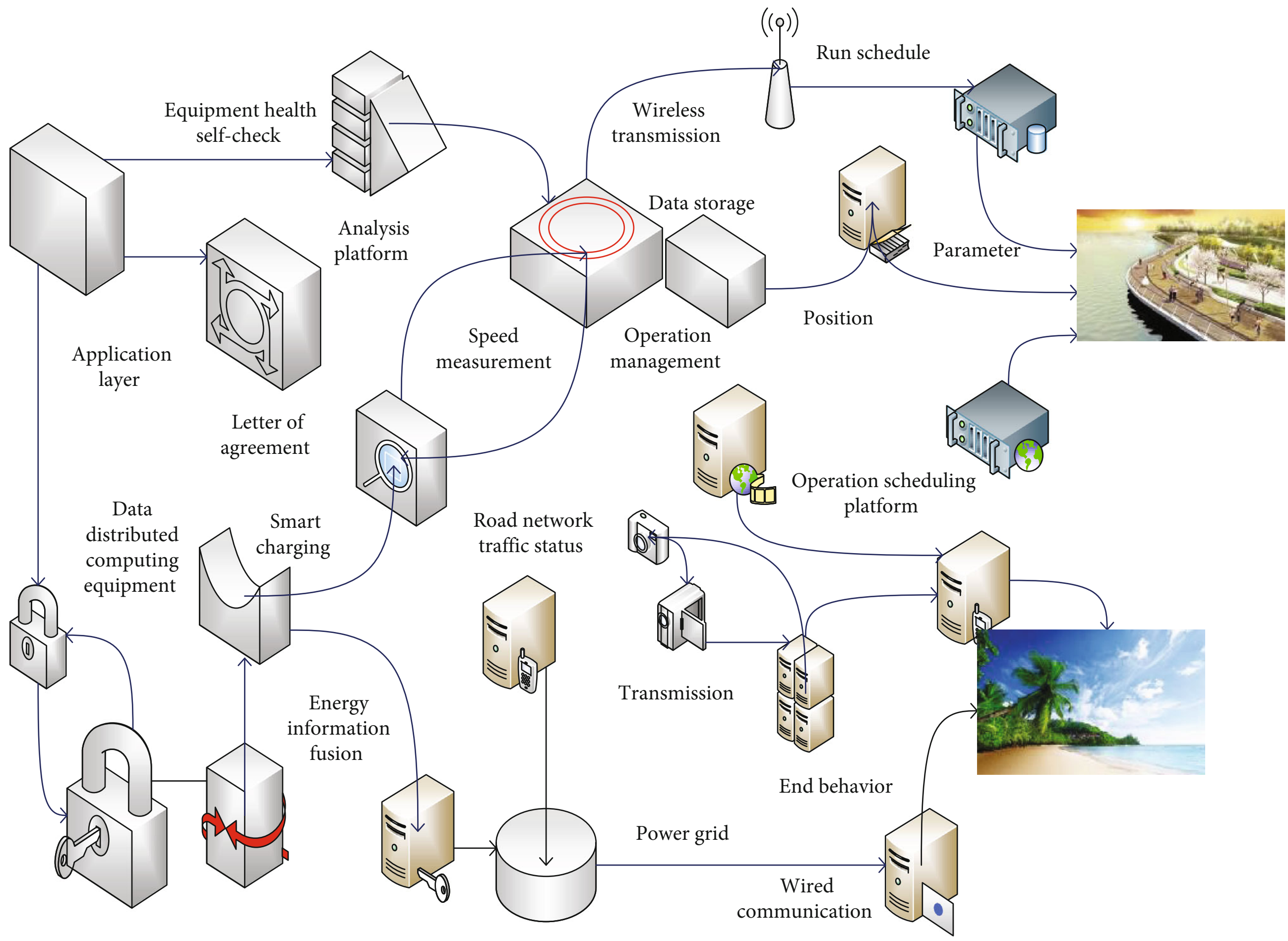

Figure 1: Environment information description framework coastal zone.

effects of the three fusion methods on four classifiers: logistic regression, SVM, random forest, and naive Bayes, to verify the effectiveness of LDA and DS model fusion and determine the consistency vector representation method of short environment information data. Based on the accurate representation of the short environmental information review data of the coastal zone, this paper adds the environmental information description data of the coastal zone and uses the same method as the environmental information collection for verification and analysis, to determine the number of fused coastal zone reviews required to fully express the coastal zone information. The structural network is shown in Figure 1.

The environmental information review data selected in this paper are randomly selected without considering the correlation between evaluations. Here, we continue to verify the rationality of selecting users' environmental information based on Pearson similarity between environmental information [11]. Based on the above experiments, the effectiveness of the proposed algorithm in the learning of multisource heterogeneous fusion representation of environmental information and images is verified by improving the classification accuracy [12]. In this paper, the planning countermeasures for postearthquake recovery and reconstruction in East Japan—laws and policies extended to the whole country—the diversified implementation of local areas are taken as the context, and the key planning countermeasures for disaster prevention and reduction of ecological disasters in the coastal zone of Japan after the East Japan earthquake are extracted and analyzed, to provide a reference for the formulation of ecological disaster prevention and reduction planning in the coastal zone of the Pearl River Delta in China [13]. In the position of Japan's disaster prevention and reduction planning system, Japan's disaster prevention and reduction planning system presents the characteristics of central and local levels [14]. Including the three programmatic legal documents formulated by the Japanese cabinet office to guide the whole country (basic law on disaster countermeasures, basic plan for disaster prevention, and business plan for disaster prevention), based on the characteristics of the region, the regional disaster prevention plan at the county level (at the same level as China's province) formulated by the prefectural government, and the regional disaster prevention plan at the city level formulated by the municipal government [15]. For the special disaster prevention and reduction planning for specific disaster forms, the relevant national departments also formulate principled provisions, and then, the governments of all prefectures, counties, cities, towns, and villages determine the specific implementation scheme based on the characteristics of their natural and social conditions [16]. Based on the experience and lessons of previous major disasters, Japan revised and adjusted the disaster prevention and reduction planning system from top to bottom [17]. For example, as one of the main research objects of this paper, the tsunami disaster prevention area construction law was put forward in 2017 based on the practice of tsunami countermeasures in the postearthquake reconstruction of East Japan. It is a special national disaster prevention and reduction plan. Based on the above tsunami disaster prevention area construction law, the government under the jurisdiction of the case city made corresponding adjustments to a series of implementation plans within its coastal zone, including the preparation planning of protective facilities, land use planning, and building construction specifications [18].

2.3. Determination of Environmental Detection Scheme and Protection Countermeasures. The coastal zone affected by the East Japan earthquake and tsunami is zoned according to the L1 and L2 immersion lines [19]. Since it is necessary to ensure the safety of life and property, the continuation of economic activities, and the necessary harbor function in the embankment after the L1 tsunami, the fortification standard of protective facilities is usually determined by the L1 tsunami, that is, the L1 immersion line coincides with the dampproof embankment to ensure that the embankment is free from the impact of tsunami [20]. In principle, normal residential, commercial, or production activities can be carried out outside the L2 flooding line (outside the sea and inside the land) and within the L1 flooding line, as long as it is ensured that residents can take effective refuge in case of disaster [21]. However, because the tsunami caused by the East Japan earthquake has caused heavy damage to a large area within the tidal embankment on the coast of Xiantai, the housing loss is serious, the saline-alkali problem of the land within the flooded area also needs to be solved, and the affected residents have psychological difficulty to accept that the location of their damaged housing is still considered safe; the town and village governments of the affected cities along the coast of Xiantai also included an l2-2m flood line as the basis for postdisaster land use and housing reconstruction site selection [22]. The l2-2m flooding line refers to the flooding line caused by the tsunami with a height of 2 m lower than the height of the most serious tsunami once in a thousand years calculated by simulation [23]. This l2-2m flooding line coincides with the flooding line of the tsunami caused by the East Japan earthquake [24]. According to the planning of the local government, residential buildings affected by disasters within the range between L1 and l2-2m lines can be relocated to safe areas with the support of government reconstruction funds; disaster public housing can be built in the area within l2-2m line [25]. Since the area beyond the L2 line is the flooding area of the once-in-a-thousand-year tsunami, refuge towers and buildings need to be set in the area to ensure that residents can realize effective refuge.

2.4. Coastal Zone Data Analysis Model and Dempster Shafer Evidence Algorithm. In accordance with the proposed comprehensive guarantee framework for the operation of the coastal marine environment three-dimensional monitoring system, the detailed design of the comprehensive guarantee was further completed, and the development environment and tools and multiple modules of the realized comprehensive guarantee system were introduced. The prototype development of a comprehensive guarantee framework for the operation of the marine environment three-dimensional real-time monitoring information service system has been realized. In this paper, DS and LDA models are used to represent the vector characteristics of coastal zone ecological data and environmental description environmental information, and then, they are integrated to accurately obtain the environmental vectorial representation that comprehensively reflects user preferences. Let the vector dimension of DS output be LC. Based on the trained PV-dm environment information vectorization representation model, if the i user of the j environment of class k evaluates the environment information as $T1$, then all the environment information evaluation vectors of the environment are K. Similarly, if the description phrase environment information D of the environment is input, its vector representation as t can also be obtained; then, for all user evaluations of the j environment in class k, the environment information processed by DS constitutes a vector space. For the LDA model, to facilitate its integration with DS, the dimension of its feature extraction module is also set as LC, that is, the number of topics selected for LDA is $C1$. For the evaluation environmental information t, the topic vector can be obtained after learning the LDA topic model, expressed as

$$C(A) = K(y(T-1), \cdots., y(t-n), u(T-d-\varphi), \cdots, u(k-d-n)). \tag{1}$$

The subject word vector corresponding to the description phrase is

$$K(Y_i, y_i) = -\frac{1}{n}\sum_{i=1}^{n}[L_i \log(L_i) + (1-L_i)\log(1-L_i)]. \tag{2}$$

In recent years, with the development of new and intelligent marine environmental elements, multiplatform sensing technology, multiplatform remote sensing technology, real-time data communication technology, relational distributed database management technology, networked data processing, and information product development technology, standardized data sharing the development of information service technology has laid a technical foundation for the establishment of a marine environment monitoring system, the implementation of long-term, continuous, comprehensive, and accurate marine environment observation and data processing, product production, data sharing, and information services. Therefore, the establishment of a marine environment monitoring system driven by the overall needs of the country is an inevitable trend in the development of marine monitoring technology. Then, for the j environment in class k, the subject word vector l of user evaluation will increase. By fusing the semantic information of evaluation environment information extracted based on DS and the subject word distribution information obtained from the LDA model, we can obtain the quantitative feature representation of user evaluation environment information with rich information. Three different fusion methods are considered here, as follows.

Connect the same user evaluation in series in the same environment to form a vector, as shown in

$$G_{\mathrm{LDA}} = \|R_1 - R_O\|_2. \tag{3}$$

The first mock exam is transformed from a single LC to a symbol definition and description. M has an m environment, which can be regarded as a feature extension. Splicing and fusion are simple and easy to operate, but they may bring feature redundancy or noise interference. Add the corresponding elements to form a new vector with dimension LC, as shown in

$$H_i = F\left(\sum_{j=1}^{k} \omega_{ij} y_j - \theta_i\right) - C * Y, \quad i \neq j. \tag{4}$$

Additive fusion does not change the feature dimension and directly accumulates the output vectors of the two types of models. It is simple and easy to operate, but it is also likely to bring noise disturbance. When the two vectors are fused by the Cartesian product, the interactive information between the dimensions of the vector to be fused can be obtained. Here, the sensor fusion method is used to fuse the DS environment information vector and LDA subject vector, as shown in

$$S_F = \frac{n}{\Delta_{\mathrm{LDAl}}} \sqrt{\sum_{s=1}^{n} (x_{ik}(F) - x(F))^2 \Delta_{\mathrm{LDAl}}(Y)}. \tag{5}$$

The fused feature vector $V(T)$ can be obtained by expanding it by line. Obviously, among the three fusion strategies, the dimension of tensor fusion is greatly increased, which is C, but the fusion method can cover more comprehensive features and information between feature interactions. Similarly, by using the above tensor fusion strategy, the fusion vector representation of environment description based on DS and LDA can be obtained. For environment j, if all the obtained user evaluation environment information vectors and environment description environment information vector $V(d)$ are directly fused, the evaluation environment information with less correlation between evaluation content and description content may bring noise and disturbance and increase the amount of calculation. Therefore, equation (6) is used for further calculation.

$$D(c) = \frac{2n1n(c)}{n^2 1n(T)} + n\left\{\frac{n + tr(c)}{n - 2 - tr(c)}\right\} - V, \tag{6}$$

$$V(d_i, w_j) - P(w_j|d_i) = \frac{P(d_i)}{\sum_{k=1}^{K} b(w_j|z_k) P(z_k|d_i)} P(w_j|d_i). \tag{7}$$

P is Pearson correlation, and the user evaluation environmental information with large correlation V and coastal zone description environmental information are selected for fusion:

$$F(Y) = \left[\frac{\zeta_1 c_1(t) + \zeta_2 c_2(p) + \zeta_3 c_3(p)}{\zeta_4 c_4(p) + \zeta_5 c_5(p) + \zeta_6 w_{ik}}\right]. \tag{8}$$

ζ is the mean of X and Y; Y_i is the variance of X_i. Select $V(T)$ of P as the representative evaluation vector of the evaluated environment, add these vectors directly to ensure that their dimensions remain unchanged, and then fuse them with $V(d)$. Strategies such as splicing, addition, or tensor fusion can be adopted to obtain the vectorized representation of the environmental information of environment J in class k, which is recorded as $V(Y)$.

For the expression of coastal zone information, the environmental platform often provides a large number of picture information in addition to using words to describe and evaluate the environment. The fusion of multisource environmental information data can more accurately represent the user's environmental information description of the environment. If the image and other data can be further integrated, it can further enrich the UGCS data's description of the environment, making it more accurate and comprehensive to represent the overall information of the user's attention to the environment. The RESNET model is used to extract the image feature information related to the coastal zone with user evaluation. Firstly, the residual network is pretrained using the ImageNet dataset, and then, the network is migrated to the environmental image feature extraction in this paper for fine-tuning. A collection of images related to the environment K

$$K_i = R * \beta(hp_i, v_i) + \varepsilon_j \beta_j + \sum_{j=1}^{p} \beta_j(x, y) \mathrm{x}_{ij}. \tag{9}$$

Input the fine-tuning RESNET network, and the vector output by the network is obtained as the feature of each picture.

$$Y(T) = K(y(k2 - 1), u(p2 - c2 - 1)). \tag{10}$$

For the feature vector set n of all image sets of the environment, the average weighting operation is adopted to obtain the vector after synthesizing all picture information. Equation (11) is the image feature representation of the environment.

$$P_0(N) = \begin{cases} 0, & x_{ik}(e) = \dfrac{N}{A}, \quad x_{jl}(e) = \dfrac{N}{A}, \\ 1, & x_{ik}(e) = Y_i \log(y_1) + (1 - Y_1)\log(1 - y_1), \quad x_{jl}(e) = \dfrac{N}{A}. \end{cases} \tag{11}$$

Environmental information and images have obvious heterogeneous characteristics. The information they represent is not only different but also complementary. Their feature extraction models are completely different, and their feature dimensions are also obviously different. Therefore, it is very important to design a heterogeneous feature data fusion strategy. Inspired by a convolution neural network, this paper proposes a heterogeneous data feature fusion method based on convolution operation. For the comprehensive characteristics of environmental information of environment K,

$$K = \left\{ \frac{1}{N} - \log_m F - \frac{D}{W} \right\} + \lambda \frac{1}{N} |X - G|, \tag{12}$$

$$G = \sum_{i=1}^{g} \left\{ P_i | \sum_{j=1}^{k} p_j^{(i)} \right\}, \tag{13}$$

$$\sqrt{R} = \frac{R^g \cap R^r || G_0 - G|}{R^g \cap R^r}. \tag{14}$$

The fusion of two types of features based on convolution is shown in

$$\frac{Y}{H} = \sum_{S-1}^{U} \sum_{d-1}^{K} f_s, DV_s, d, \tag{15}$$

$$H(D_i, w_j) = Y(d_i) \frac{P(w_j | d_i)}{\sum_{k=1}^{K} (w_j | z_k) P(z_k | d_i)} + D(w_j | d_i). \tag{16}$$

Compared with other fusion methods such as LDA, DS, and SVM, the fusion method proposed in this study is highly efficient and reliable and uses advanced information processing and management technologies to target the ocean power and ecology obtained by the system data integration module. Environmental monitoring real-time, quasi-real-time, history, business guidance, and other available data in the demonstration area are very applicable in the article.

In the above formula, the number of user evaluation texts of the k environmental information set Y, the t environmental information set D is $h(D, w)$, which does not need to consider the dimension of the features to be fused, and the feature dimension after fusion is far lower than that of tensor fusion. Compared with stitching fusion, convolution fusion can not only fully consider the interaction of heterogeneous data features in all dimensions but also enhance the important features in the data and filter the noise features.

In response to the overall needs of marine environmental monitoring data and marine monitoring information for marine rights maintenance, disaster prevention and mitigation, ecological protection, resource development, marine engineering and shipping, and national defense construction, new and intelligent multiplatform sensing and data acquisition of marine environmental elements are carried out technology, multiplatform remote sensing monitoring and surveillance application technology, and mobile target detection and recognition technology. This paper selects relevant datasets to verify the performance of the proposed algorithm. As shown in Figure 2, the experiments are applied to the evaluation of short environmental information + category environmental information fusion representation learning and environmental information + image fusion representation learning, respectively. In the short environmental information comment feature representation experiment, the comment data of five types of coastal zones such as automobile, outdoor sports environment, office supplies, toys and games, and Android software are selected, the environmental information comment data in the comment data are extracted and labeled to build a balanced experimental dataset, and then it is divided into training set and test set at the ratio of 3 : 1, for example, verification. In the experiment of determining the minimum number of comments required to characterize the coastal zone and image fusion representation of environmental information, due to the loss and damage of some categories of coastal zone image data in the dataset, the categories in Amazon dataset are pet supplies, software, and office supplies; the review text field in the comment dataset of toys and games and the description field in the meta dataset are combined correspondingly according to the coastal zone number as in field.

3. Results and Analysis

3.1. Multisource Fusion Coastal Zone Data Acquisition and Analysis. The completion of a function often requires many function calls back and forth between the client and the server to complete. In the network environment, the impact of these calls on the response speed and stability of the system can be ignored. However, in the network environment, these factors are often a key determinant of whether the entire system can work normally. Therefore, multisource heterogeneous UGCS recommends the use of large data volume for one-time information exchange. This paper proposes a learning strategy for environment vectorization representation based on multisource heterogeneous UGCS data. The coastal zone "chair" not only has the environmental information description and image provided by the sensor but also the evaluation provided by the buyer. This information is fused, expressed, and learned to form a vector containing the information features of different angles of the environment. In this paper, the DS model in Gensim library is used to train the preprocessed coastal zone comments, and then, the basic parameters of DS with the best classification effect are determined through cross-validation and grid search, as shown in Table 1.

Parameter value and parameter description min_ COUNT1 discards words with word frequency less than 1.

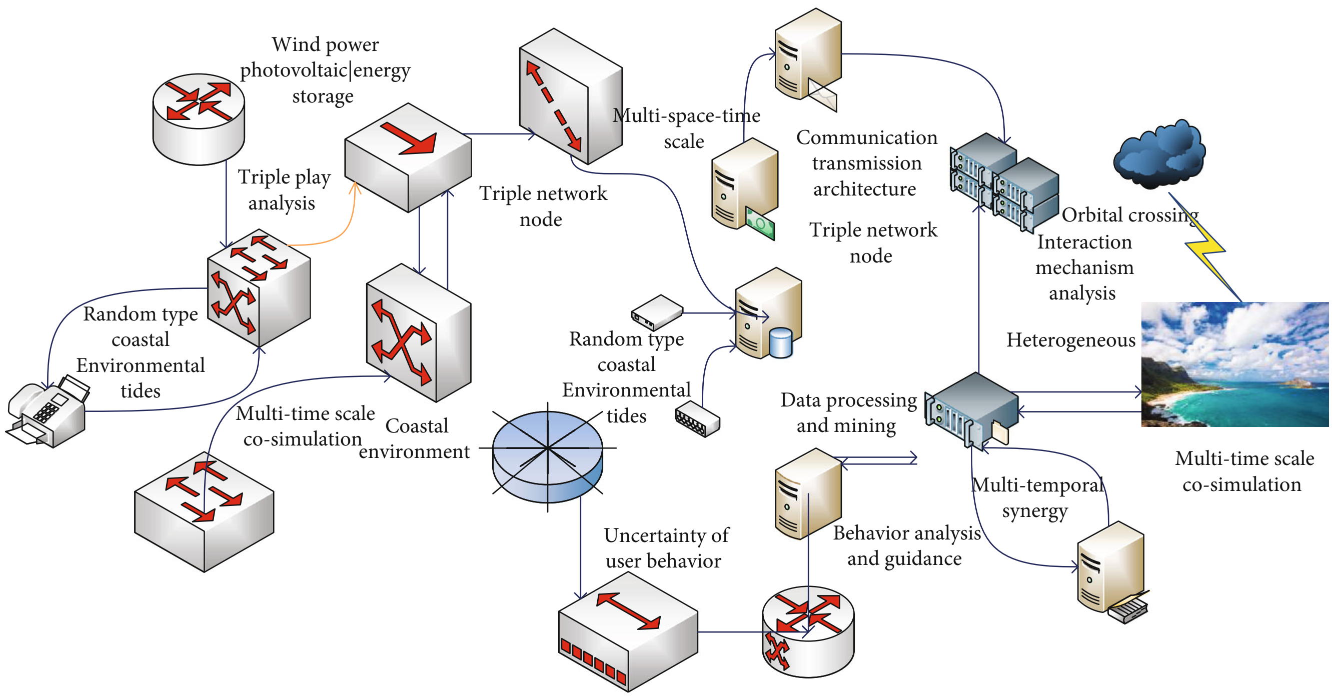

Figure 2: Category environmental information fusion learns.

Table 1: Basic parameters of DS with the best classification effect.

Item	Parameter	End behavior	Smart charging	Orbital crossing
Application layer	6.11	7.35	4.58	9.51
Information fusion	4.97	7.6	4.7	7.8
Run schedule	4.78	6.57	2.42	8.55
Operation management	2.4	4.66	0.66	8.65
Data storage	1.12	3.76	0.45	6.53
Analysis platform	-0.53	3.41	0.82	6.6

The maximum distance vector between the current word and the predicted word in window2_ Dimension HS0 of size200 eigenvector calls negative sampling negative 5 noise word frequency alpha 0.25 initial learning rate min_ Alpha0.00025 minimum learning rate DM1 uses pv-dm algorithm to extract environmental information feature vector by DS, and the vector dimension has an important impact on subsequent fusion. Therefore, the classification accuracy of environmental information features with different dimensions on each classifier is considered here to determine the dimension of DS output. If the feature vector dimension of the DS model is too small, it cannot fully represent the environment information of the corpus, and if the feature vector dimension is too large, it will increase the time complexity of training and operation. Therefore, the feature vector dimension is set to increase from 50 to 300 dimensions, and the classification accuracy is recorded every 50 dimensions.

As shown in Table 2, the reference water level not only determines the elevation of the refuge but also determines the floor elevation of specific buildings in the disaster warning area. The reference water level refers to the total height of the wave height (tsunami, storm surge, or overtopping) superimposed by the surge caused by the obstruction of the building. Refuge places include refuge towers, refuge buildings, and refuge platforms. The elevation of the refuge layer shall be above the reference water level of the area. In the specific calculation, the disaster warning area is divided into several cells (e.g., 10 m × 10 m), and the reference water level height of the cell where the facility is located is obtained through simulation calculation. The prerequisite for human development and use of the ocean is to understand and master the ocean. However, the basis for understanding and mastering the ocean is the implementation of long-term, continuous, comprehensive, and accurate observation of the marine environment in order to grasp the status and changing laws of the marine environment to make correct predictions and evaluations of the marine environment. In turn, it provides the necessary basic data and scientific basis for the rational development and utilization of the ocean, marine environmental protection, marine engineering design, and safety guarantee for marine operations so that marine development enters an orderly and sustainable development track.

In view of the particularity of the marine environment three-dimensional monitoring, this paper takes the integrated guarantee of the marine environment three-dimensional monitoring system operation as the main research objective. Based on the original marine environment monitoring system,

Table 2: Elevation height of the standard refuge area.

Item	Dimension	Heterogeneous	Multisource	Massive
Power grid	3.73	3.1	6.23	5.24
Charge	2.84	5.47	7.5	7.1
Environment	2.03	7.82	10.35	8.59
Speed measurement	3.39	7.23	9.84	8.41
Position	5.66	7.21	11.16	10.71

Table 3: Fortification height of the dyke.

Item	Operational control	Technology	Interaction	Mechanism	Driven users
Random type	8.12	14.58	19.46	6.74	9.69
Coastal	8.86	14.82	17.81	6.08	8.98
Environmental	7.15	13.38	17.73	5.72	7.82
Multitemporal	5.93	13.14	17.97	6.41	7.2
Multispace	6.34	12.68	18.89	6.71	6.65
Time scale	4.78	11.03	17.99	6.4	5.49

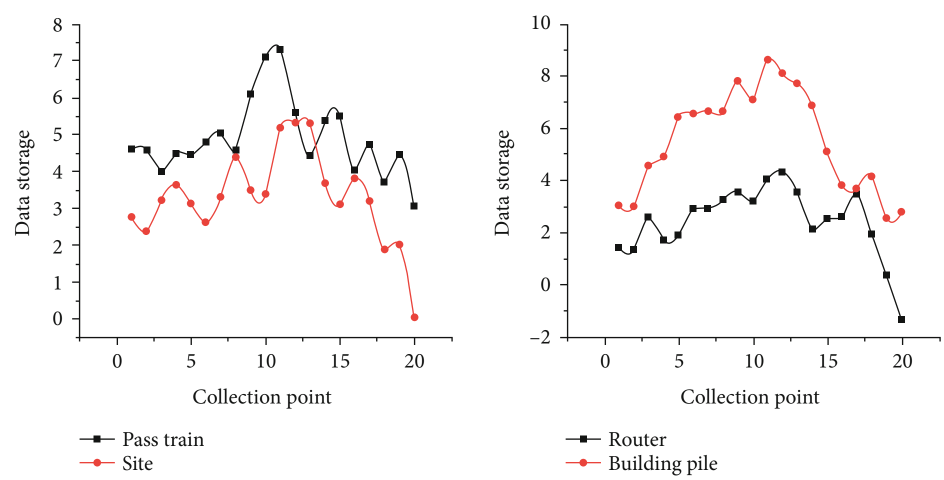

Figure 3: The flooded zone of the tsunami caused by the earthquake.

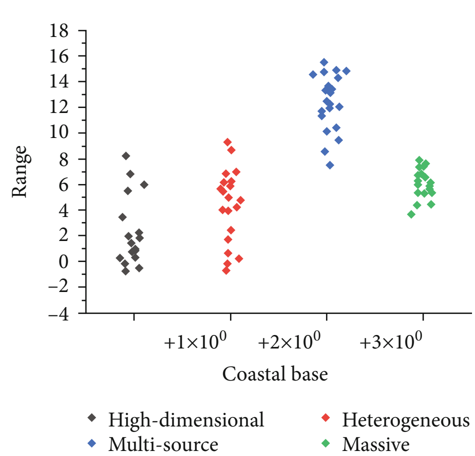

Figure 4: The range and depth of the tsunami flooding.

the research on the LDA and DS model fusion of the relevant operation guarantee technology is carried out. As shown in Table 3, the fortification height of the dampproof embankment is determined by the design tsunami level of the tsunami group with high frequency in decades and hundreds of years and the highest value of the design storm surge tide level after superposition of wave factors. For Tokyo Bay, the storm surge design tide level is always greater than the tsunami design water level. UPI international urban planning combination of prevention and reduction: land use and refuge countermeasures in the coastal zone of Sendai City and Osaka City. Because the key factor determining the immersion depth and scope of the Tokyo Bay is the height of the storm surge, therefore, the promotion of tsunami disaster prevention area construction has not had too much impact on the land use and refuge machines in its coastal zone.

As shown in Figure 3, the outermost layer of the coastal zone is the flooded zone caused by the tsunami caused by the

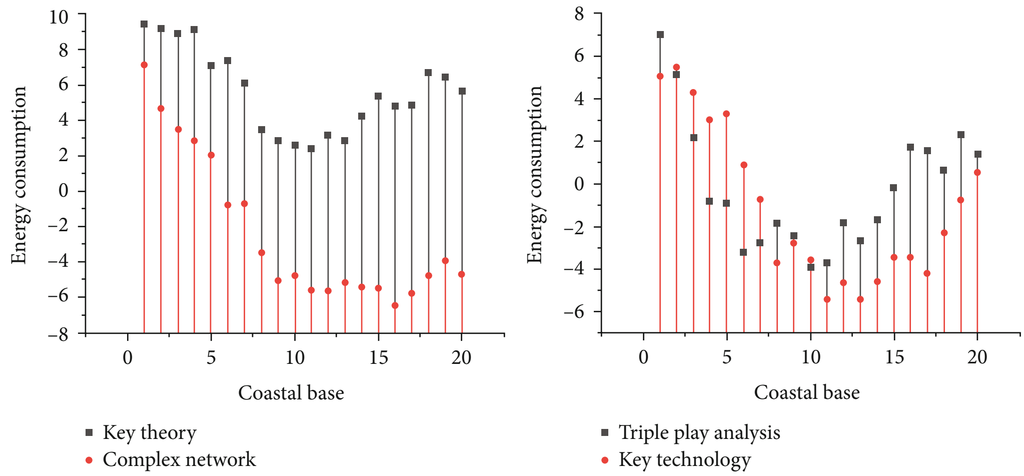

Figure 5: Distance between flooding depth and coastline.

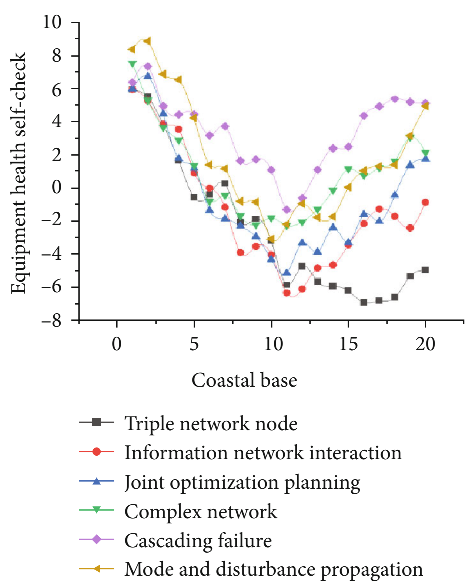

Figure 6: Coastal ecological disaster.

East Japan earthquake. It is planned to be a coastal park and a beach in the future. The second floor is farmland and scattered residential colonies, such as the Okada colony and Pushing colony. Set up main motor vehicle refuge roads between the colonies, and delimit pedestrian refuge paths according to people's behavioral characteristics. The refuge paths are perpendicular to the coast and move towards the highlands away from the coast, which is also known as "run up!" Asylum training is carried out by communities.

After the Ministry of Land, Resources, and Transportation gradually prepared the relevant draft of tsunami disaster prevention area construction, the immersion range and depth of the largest tsunami that may occur in Osaka Bay were simulated and calculated, and the tsunami immersion scenario was obtained, as shown in Figure 4. According to the existing flooding scenario, it can be determined that the refuge path in the coastal zone of Osaka City is still generally perpendicular to the coast and moves inland away from the coast. In some areas, it is necessary to take refuge away from the river.

As shown in Figure 5, as a dense urban coastal zone, its immersion depth depends not only on the distance from the coastline but also on the terrain height, urban building density, distance from the river, and drainage conditions. Some peninsula areas close to the coastline still have low immersion depth due to flat terrain and low building density. Even if there is a certain distance from the coastline, it still has a high risk of flooding due to its proximity to rivers, high building density, and poor drainage conditions. Therefore, it is necessary to closely combine the local natural and social conditions when formulating the construction specifications of buildings in the disaster warning area. The delimitation and specific implementation plan of tsunami disaster warning areas in Osaka city are still in progress.

3.2. Coastal Ecological Environment Monitoring and Construction. As shown in Figure 6, the enlightenment to China's Pearl River Delta coastal zone ecological disaster prevention and mitigation planning, the Pearl River Delta coastal zone presents the contradiction between the improvement of fortification standards under the risk of coastal zone ecological disasters and the living density and development needs of existing coastal zones. A series of coastal zone ecological disaster response planning strategies combined with prevention and reduction after the East Japan earthquake can provide a reference for this.

Running real-time monitoring client software is deployed in each monitoring terminal to achieve status information extraction and reporting, running real-time monitoring server software is deployed in the data center to achieve real-time display and remote control of monitoring service system status information, and information sharing and application service software are deployed on shared servers to realize the security system information sharing service and application and achieve timely warning. As shown in Figure 7, the Pearl River Delta coastal zone should comprehensively consider the ecological disaster risk of the coastal

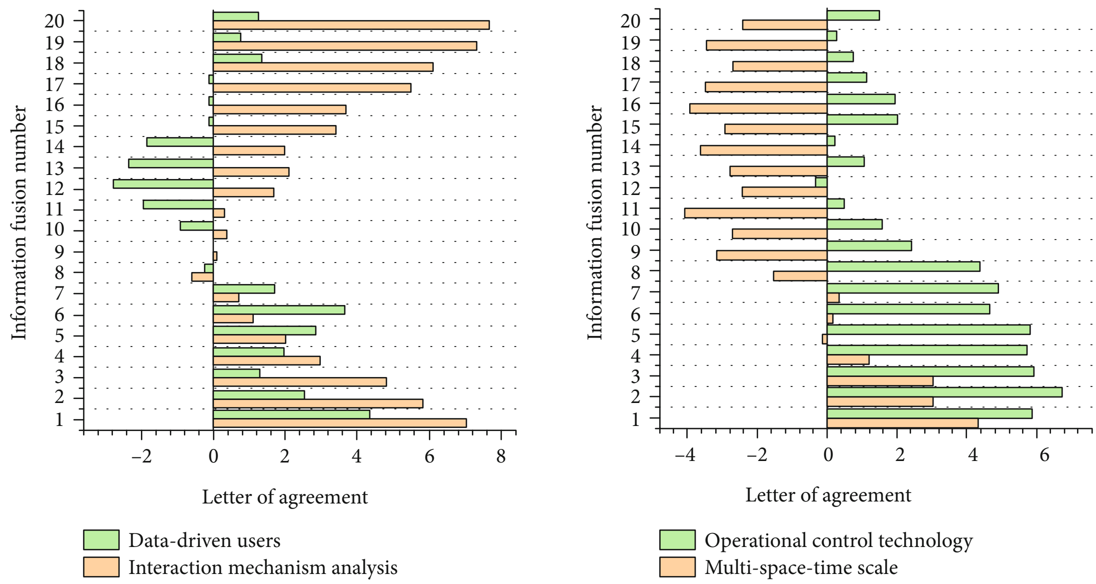

Figure 7: Coastal ecological disaster risk.

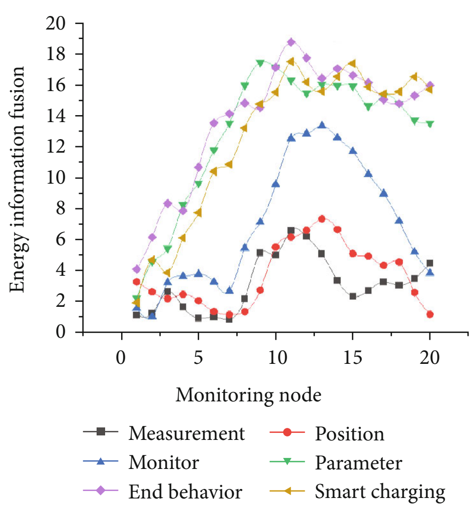

Figure 8: Storm surge level in overseas seas.

zone and divide the disaster risk into the highest tide level of tsunami group or storm surge with high frequency during the facility supply period and the tide level of tsunami or storm surge with the largest possible level. Revise the fortification level of protective facilities according to the tide level with high frequency. Limit the land use and building construction according to the maximum level tide level, to achieve effective refuge and minimize the losses caused by disasters.

As shown in Figure 8, the maximum tidal level of storm surge in Zhuhai offshore caused by typhoons is 4.29 m. The coastal area of the Pearl River Delta measured by simulation calculation has a high tsunami risk below 9 m, and the design tidal level of Zhuhai coastal protective facilities is 3.11 m or even lower. It can be preliminarily considered that the fortification standard of Zhuhai coastal zone protection facilities is determined by storm surge. The tsunami risk of 9 m and below can be used as the standard for dividing dangerous areas and become the basis for regional land use and building construction norms.

China's current disaster response strategy still focuses on disaster prevention countermeasures, as shown in Figure 9. The increased disaster reduction dimension based on Japan's experience is the key to improve China's disaster response system and also provides an important idea to solve the spear between the improvement of fortification standards and residential density and development needs in the coastal zone of the Pearl River Delta, that is, whether to admit that disasters cannot be resisted completely through technical means. Therefore, it is necessary to enhance and give full play to the self-help power of the community to ensure the safety of life and property and minimize the losses caused by disasters. The delimitation of disaster risk areas and the provisions on land and buildings within its scope essentially recognize that the area can be impacted by disasters. It is the setting of prevention and control standards after comprehensive consideration of disaster reduction countermeasures. In this paper, it is still classified as disaster prevention countermeasures for ease of understanding. On this basis, the possible disaster reduction countermeasures are summarized as follows.

As shown in Figure 10, for the built-up area of the coastal zone, the existing dampproof embankment shall be verified according to the tide level height of the once-in-a-century storm surge, and the measures of improving the fortification standard or strengthening and maintenance shall be taken. Delimit the tsunami risk area according to the tsunami of 9 m and below, and take waterproof countermeasures for specific buildings in the area (such as hospitals, welfare facilities for children and the elderly, and residential buildings, whose users have high requirements for safety), including changing the location of their residential part, improving the floor of their residential part, and strengthening the main structure of the building with earthquake and

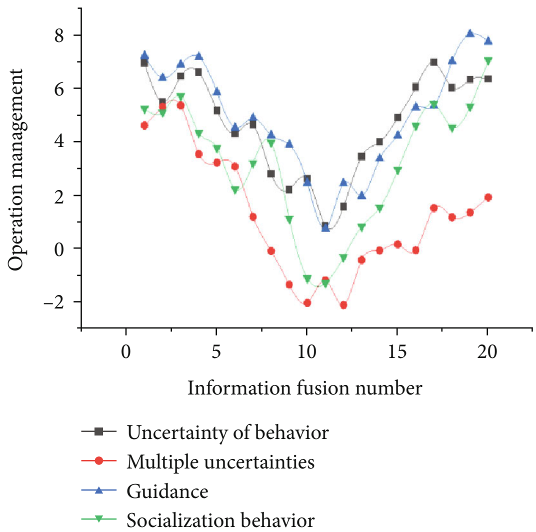

Figure 9: Coastal fortification standards.

water resistance; waterproof board and water stop door shall be set in the area below the immersion line, and important electrical equipment shall be moved to a high place. The floor elevation standard can be determined through the simulation calculation of the reference water level height of the cell.

As shown in Figure 11, the postdisaster reconstruction of Sendai City is one of the prototype cities for formulating the relevant planning for the construction of a tsunami disaster prevention area. Its disaster warning area is bounded by the l2-2 m line, which is equivalent to the flooded area of the East Japan earthquake and tsunami, and most of it is located outside the East Road of Sendai in the figure. In the warning area, its land use shows obvious stratification characteristics parallel to the coast. To realize the above coastal zone ecological disaster response strategy combining disaster prevention and reduction, the coordination and cooperation of water conservancy, transportation, housing, planning, construction, and other government functional departments, social organizations, and community residents are required. This puts forward requirements for clarifying the rights and responsibilities of various departments, formulating multiagent cooperation mechanisms, and determining the action process in advance, which should be paid attention to.

As shown in Figure 12, in the field of personalized services, various application apps have become indispensable tools for life and even work. In the process of using apps, users will not only produce a large amount of real-time communication information but also provide a large amount of data such as dynamically changing environmental information comments, scoring, labels, pictures, and videos. Obviously, under the current network technology, users have become active creators of data, providing a large number of user-generated content (UGCS), which has become a data component with extremely important application value in the field of personalized services. UGC data reflecting user personalized information has obvious multisource heterogeneous characteristics. Its multisource is reflected in that the description and evaluation of the same object are given by different people in a variety of different data forms (such as environmental information, image, or video) from different angles.

Shown in Figure 13 is the zoning planning of the Osaka Bay coastal zone. In addition, compared with the tsunami disaster prevention regional construction planning, which emphasizes the zoning of land use, building construction, and refuge countermeasures perpendicular to the coast, the coastal preservation planning of Osaka Bay also highlights the zoning planning parallel to the coastline due to specific regional conditions. Therefore, according to different coastal types, ecology, and hinterland characteristics, Osaka prefecture divides the coastal zone horizontally into living area, rest area, and production and living integration area. In the planning for the preparation of coastal protection facilities, the specific implementation scheme shall be formulated in close combination with the characteristics and requirements of the zoning where the facility points are located, such as not only improving the fortification standard of protection facilities but also planning and designing its hydrophilicity and its effect on the surrounding environment of the land.

As shown in Figure 14, the number of indicators in multisource information fusion in this paper is 16; there are 3251 data, 2866 meaningful information, and 1869 data including ecological cycle. After multisource information fusion and decision-making, it is obtained that the index equilibrium module in the DS algorithm in this paper is 0.52, the sensitivity is 0.68, and the independence is 0.42. Among them, the range of sensitivity is the largest. In the simulation results, the eco-economic coefficient can be increased from 12% to 36%. There is a high risk of tsunami impact along the coast with a tide height of 9 m and below. Due to the evolution of urban development, the coastal areas of Zhuhai have high residential density and development needs.

4. Discussion

How to achieve efficient personalized search and recommendation in a large number of user-generated data environments has attracted extensive attention in the current personalized service field. To achieve the above tasks, the vectorial representation learning of UGC multisource heterogeneous data is very important. Many research achievements have been made in the fields of environmental information and image classification. For multisource heterogeneous UGC data, because the data comes from the evaluation environment information of different users, the label description of the environment, and the picture information of the environment, the evaluation environment information is mostly oral, fragmented, and noisy short environment information, the label is not unique, and the picture quality is uneven; therefore, it is difficult to fuse and represent this kind of multisource heterogeneous data.

The commercial operation of the marine environment three-dimensional monitoring system directly affects the operation and development of various marine applications.

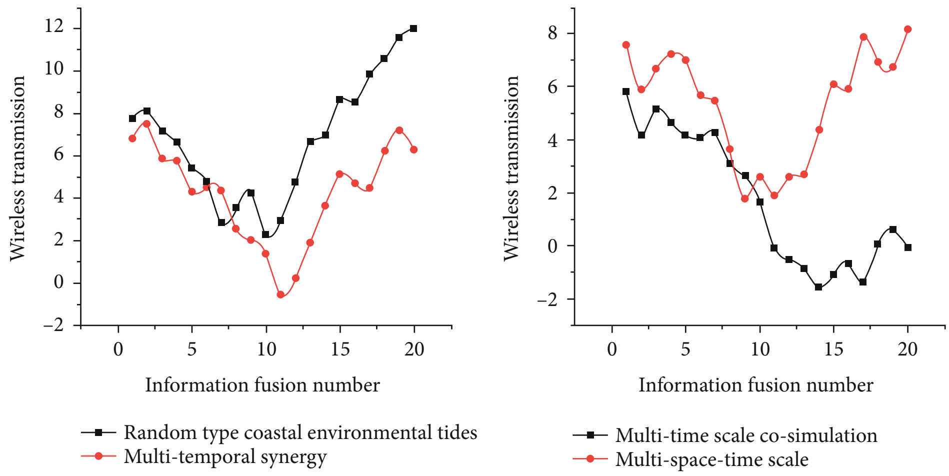

Figure 10: Verification of storm surge level and existing dykes.

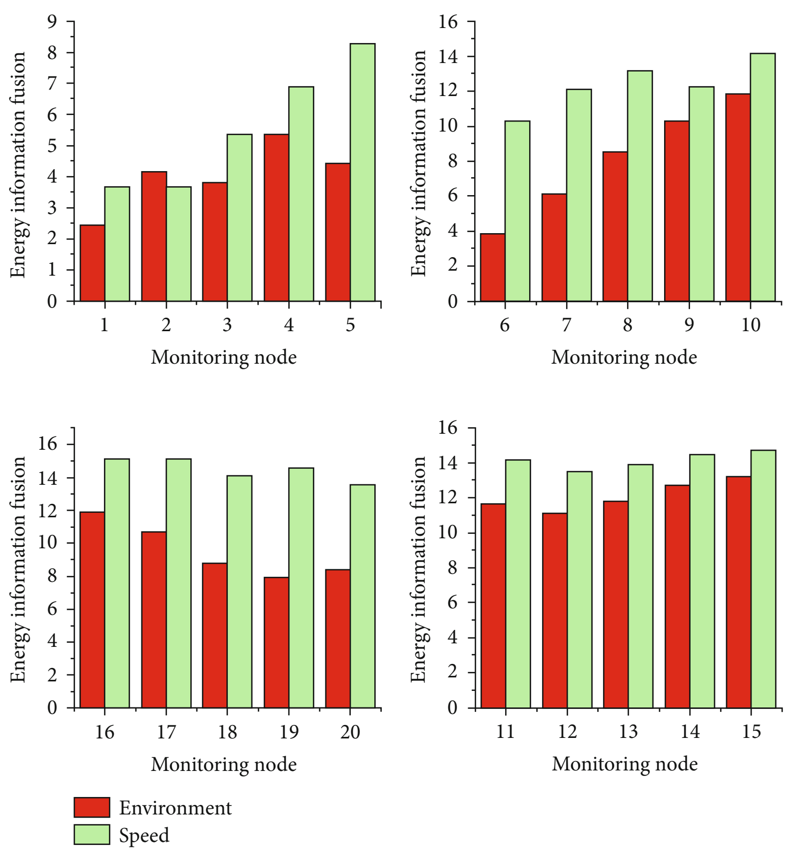

Figure 11: Planning related to tsunami disaster prevention area construction.

Starting from mastering the status and changing laws of the marine environment, the only way to implement long-term, continuous observation and application services of the marine environment is to ensure that the marine environment monitoring system is in a state of operationalization. In response to the need for the stable operation of the marine environment three-dimensional monitoring system, this paper researches and develops the structure of guarantee resources, the framework of the comprehensive guarantee system and the various technologies involved, and realizes a set of operations and maintenance plans for the marine environment three-dimensional monitoring system.

The marine environment three-dimensional monitoring system provides the necessary basic resources and data basis for the maintenance of marine rights and interests, disaster prevention and mitigation, ecological protection, resource development, and decision-making assistance and provides the possibility for the sustainable development of marine

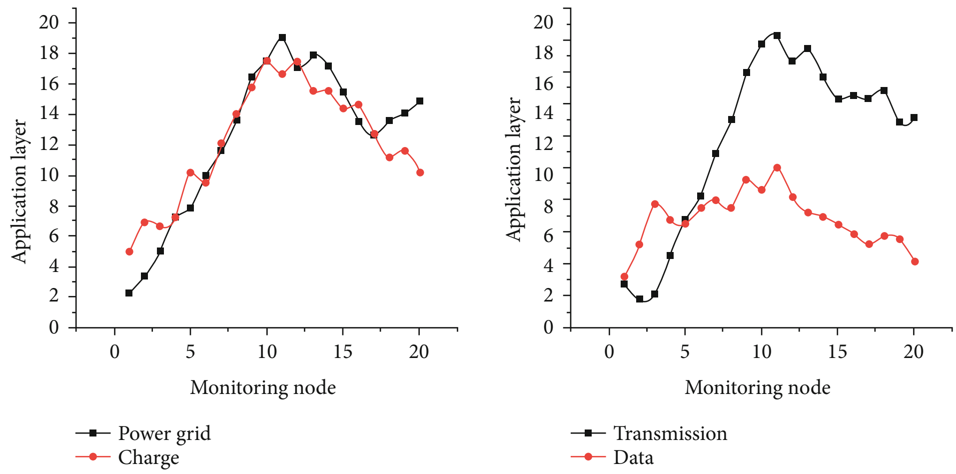

Figure 12: Real-time information exchange environment.

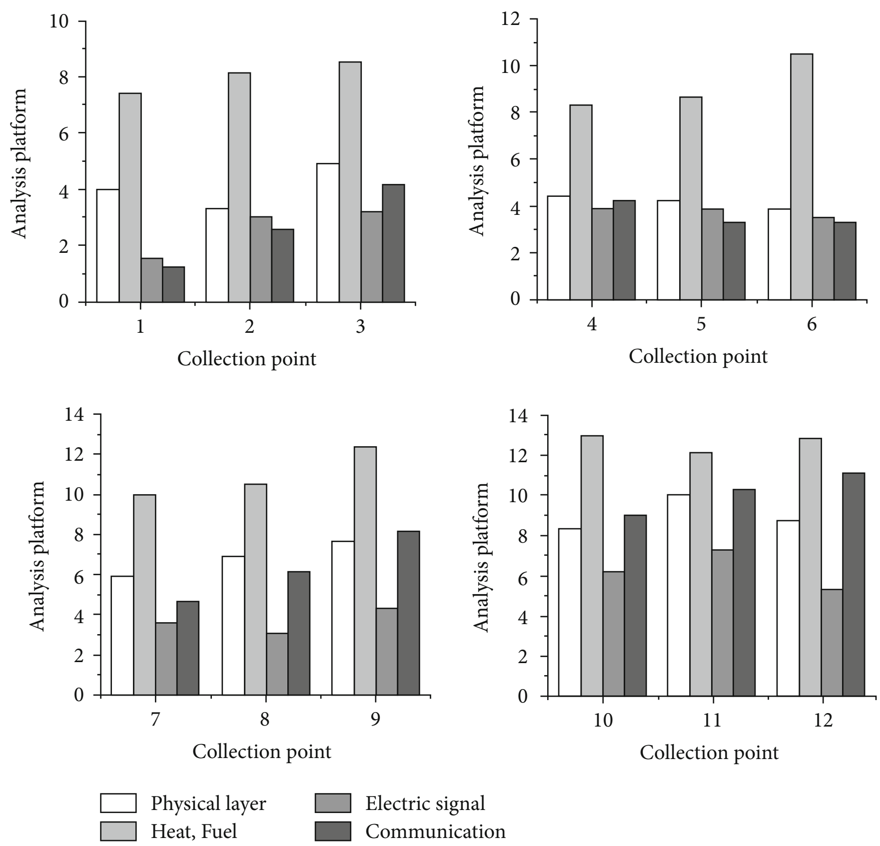

Figure 13: Coastal zone regional construction planning.

undertakings. A complete marine environment monitoring system consists of three parts: three-dimensional observation of the marine environment, data communication and management, and data processing and application. The experience and lessons of the East Japan earthquake once again proved that there is no upper limit for the fortification of natural disasters. Therefore, based on the experience and lessons of the Hanshin earthquake, Japan further put forward a new tsunami response strategy with the concept of "combination of prevention and reduction": disasters with high frequency should be strictly prevented and controlled through scientific means. In the face of a wide area, a complex and long-term disaster such as the East Japan earthquake, we should consider preset the most unfavorable situation of the disaster, delimit its risk area, ensure the life safety of the victims in the area, and make full use of the community self-help ability so that they can take refuge effectively and minimize the losses caused by the disaster

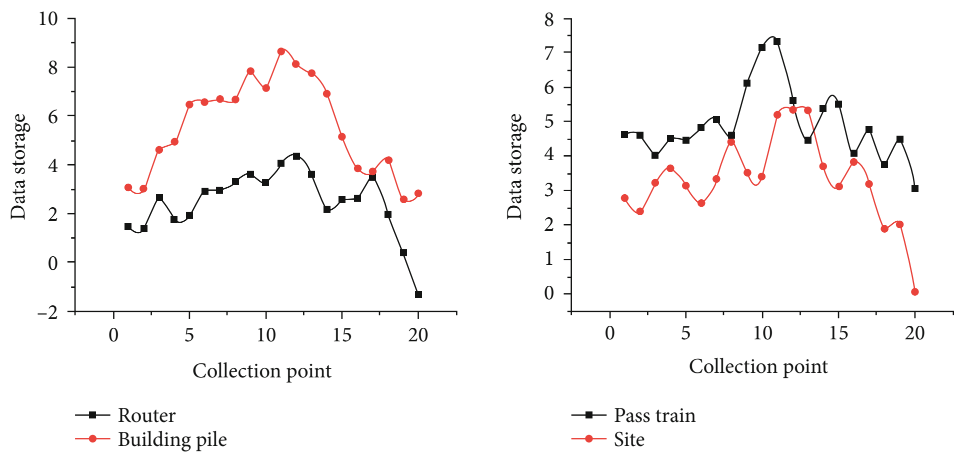

FIGURE 14: Number of indicators in multisource information fusion.

and recover from the disaster as soon as possible. Due to the frequent occurrence of natural disasters, Japan has accumulated rich experience in disaster response and adjusted and improved its disaster prevention and reduction planning based on the experience and lessons of previous disasters. Taking Zhuhai City after the "Tiange" typhoon as an example, the net hydrological observation facility of "Tiange" typhoon recorded the tide level in the open sea of Zhuhai as high as 4.29 m, breaking through the historical highest tide level of 3.37 m. As a wave protection facility and an important traffic and landscape function, the design tide level area of some sections of Lovers Road along the coast of Zhuhai is only 3.11 m, and the length of damaged areas is more than 45 km. The fortification standard needs to be improved. Set refuge places, including high platforms, refuge towers, and refuge buildings. The refuge elevation is also determined according to the reference water level height of the cell. It is necessary to carry out disaster prevention education for residents in ordinary times, guide residents on how to correctly obtain disaster risk information, carry out refuge training, and guide them on the time when they should take refuge action according to the behavior characteristics of different residents.

5. Conclusions

The research on resource management of intelligent buildings is mainly to integrate the resources of daily property management such as property equipment, property services, and information release of smart buildings by property companies to form a unified comprehensive information platform. The multisource information platform can provide users with advanced security protection, information services, property management, and other services, in order to create a safe, comfortable, convenient, and efficient living space for users and enhance the competitiveness of the enterprise market. This paper uses the method of multisource information fusion for quantitative index analysis, which can provide data support for coastal ecological environment detection, to establish a more perfect protection system. Therefore, although the Pearl River Delta coastal zone has the requirements of improving the fortification height of protective facilities and avoiding disasters, it is in contradiction with the existing urban structure and residential density, good coastal landscape vision, and the development demand for coastal land. The two typhoon disasters exposed the lack of wave protection facilities along the Pearl River Delta. In the existing meteorological disaster, early warning system including typhoons, rainstorms, and blizzard in China, based on early warning of river water volume, the flooding risk early warning mechanism of tsunami or storm surge in specific areas can be added according to the scenario simulation calculation of tide level and protective facilities. Within the disaster risk area, the refuge path shall be set in advance. According to the characteristics of coastal disasters, the refuge direction shall be the highland or inland area away from the coast and away from the river entering the sea.

Data Availability

No data were used to support this study.

Conflicts of Interest

There are no potential competing interests in our paper.

Authors' Contributions

All authors have seen the manuscript and approved to submit to your journal.

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